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Subramaniam (T. V.). **Field Control of the Tobacco Stem Borer.**—*Mysore agric. Cal. 1939–40* p. 51, 2 pls. Bangalore, 1939.

In Mysore, wilting of leaves of tobacco seedlings a few days after transplanting indicates infestation by the tobacco stem borer [*Phthorimaea heliopa*, Lw.]. Control in the early stages of the growth of the plant is essential. All leaves that are wilting should be removed close to the stem in order to destroy the larvae in the mid-rib or leaf stalk, and galls in the plant stems should be split with a knife and pressed with the fingers to crush the larvae in them [*cf.* *R.A.E.*, A **22** 624].

The Cardamom Hairy Caterpillar (Fam. Eupterotidae) and its Control in the Mysore State.—*Circ. Dep. Agric. Mysore* no. 65, 4 pp., 2 pls. Bangalore, 1939.

The cardamom hairy caterpillar, a Eupterotid that caused widespread damage to cardamom [*Elettaria cardamomum*] and shade trees in Mysore in 1922 and the following years [*R.A.E.*, A **13** 72; **15** 358], appeared in large numbers in the same areas in 1937 and 1938 and defoliated shade trees and later cardamom plants and also severely attacked coffee on two estates. The damage was, however, considerably less than in the previous infestation and much less severe in 1938 than in 1937. Oviposition begins with the south-west monsoon. The full-fed larvae congregate at the bases of the tree-trunks in October–December and pupate in the débris under the trees. The pupal stage lasts about 8 months. The recommended control measure is the collection of pupae. In 1937, many of the larvae were killed by a fungous disease that attacks them when they are congregating on the trunks of the trees, but in 1938 the disease was absent, probably owing to the failure of the north-east monsoon rains. The larvae are also attacked by a Dipterous parasite, which is, however, of minor importance.

[Uspenskiĭ (F. M.).] **Успенский (Ф. М.). Contribution to the Bioecology of the Spider Mite. (Preliminary Data.)** [*In Russian.*]—*Trud. sredneaz. Sta. Zashch. Rast.* no. 2 pp. 3–25, 8 graphs. Tashkent, 1937. [Recd. 1939.]

In continuation of previous investigations [*cf.* *R.A.E.*, A **20** 576], the effect of temperature and humidity on infestation of cotton by the red spider [*Tetranychus turkestani*, Ugar. & Nik. (*cf.* **26** 530)] was studied in Uzbekistan in 1935. The mite developed slowly in early summer and rapidly in July; it became most abundant at the end of July and beginning of August, after which its fertility decreased and its development was protracted [*cf.* **20** 619]. From a comparison of data recorded in July–September 1935 by meteorological stations in Kokand (northern Uzbekistan) and Ashkhabad (southern Turkmenistan) with data on the fluctuations in the increase in the growth of infested cotton plants in selected plots there, the author concludes that the optimum conditions for a mass increase of the mite on cotton occur when the stations record a temperature of 29–30°C. [84·2–86°F.] and a relative humidity of 35–40 per cent. This was confirmed by comparing the fluctuations in the extent of the infested areas under cotton in 1930–35 in different regions in Uzbekistan with the meteorological conditions that prevailed there in those years in May–September.

Since, however, the temperature and humidity among cotton plants differ from those at a height of 7 ft. or more above the ground, humidity being much higher near the soil and temperature usually much lower, and since these factors also vary considerably in different parts of a given cotton field, observations on the intensity of the development of the mite were carried out in 1935 near Kokand in three plots of cotton that differed in microclimate. Periodic estimates of the mite population per plot during the summer showed that its increase in a ten-day period depends on the temperature and humidity in the preceding ten days, as these factors apparently affect the fertility of the females and the duration of the development of a generation. The optimum conditions for intense multiplication were a combination of a temperature of 28–29°C. [82·4–84·2°F.] and a humidity of 55–65 per cent. among the cotton plants [*cf.* **20** 599].

In Uzbekistan, a marked decrease in the abundance of the mite since 1928 has occurred every third year, these years being characterised by periods of low temperature and high humidity in May and July, whereas the years of outbreaks were characterised by high temperature and low humidity in these months. As the conditions in May and July were usually similar and those in June did not appear to have any significant effect on outbreaks, the author suggests that the probable extent of infestation in any season could be predicted on the basis of the meteorological conditions that prevail in May. In the Uzbek Republic, the zones in which the mite is constantly present and in which the weather conditions are most favourable for outbreaks are the eastern part of the central area (Samarkand, etc.), the valley of Ferghana, the region of Khorezm and, when rainfall in the spring is not abundant, the region of Tashkent. The damage is less important in Bukhara and the western and central parts of the southern region.

Infestation is considerably reduced by the Coccinellid, *Stethorus punctillum*, Weise, which in 1935 practically eliminated the mite on cotton near Samarkand.

[TIMOKHINA (N. I.).] **Тимохина (Н. И.). Contribution to the Question of Emulsions.** [*In Russian.*]—*Trud. sredneaz. Sta. Zashch. Rast.* no. 2 pp. 65–71, 13 refs. Tashkent, 1937. [Recd. 1939.]

In the course of laboratory investigations on the preparation of stock emulsions of the type of concentrated jellies [*cf. R.A.E.*, A **20** 201] made of various distillates of petroleum, sodium soap and water, the author found that certain combinations of the components resulted in water-in-oil emulsions that did not turn into oil-in-water emulsions when more water was added. The jellies of the oil-in-water type did not alter when stored for lengthy periods, but after four years, some of them passed completely to the water-in-oil phase, while others did so partly, this exhibiting the co-existence of both phases. These concentrated jellies would not, however, be practical for large-scale use in insecticides, as their preparation is complicated, and the author suggests, therefore, that " instantaneous " emulsions may be substituted for them. For these emulsions no soap is required, as the latter is produced and emulsification occurs immediately when the oil, in which the fatty acids have an almost molecular dispersion, is shaken up with a water solution of alkali and neutralisation takes place. With certain combinations of the components, a semi-solid stock emulsion is obtained, but it will not keep longer than 24 hours. The instantaneous stock emulsions tested by the author contained, besides water, 1·3 per cent. sodium hydroxide, 10–12 per cent. acidol and 50–72 per cent. mineral oil. Acidol consists of naphthene acids isolated from the alkali residue obtained in refining solar oil and kerosene.

[Bezrukova (T. I.).] **Безрукова (Т. И.). Evaluation of the comparative Toxicity of Preparations of Fluorine and Arsenic.** [*In Russian.*]—*Trud. sredneaz. Sta. Zashch. Rast.* no. 2 pp. 72–85, 1 fig., 18 refs. Tashkent, 1937. [Recd. 1939].

An account is given of the technique and results of laboratory experiments in Uzbekistan to determine whether fluorine compounds can be used as substitutes for arsenicals against phytophagous insects. The insects used in the tests were *Calliptamus italicus*, L., larvae and adults of *Hypera* (*Phytonomus*) *variabilis*, Hbst., adults of *Rhynchites auratus ferganensis*, Nevsk., and larvae of *Agrotis* (*Feltia*) *segetum*, Schiff., *Lymantria* (*Porthetria*) *dispar*, L., and *Bombyx mori*, L. They were fed on dusted leaves, and, in tests on a given species, the rate of application of each poison was the same. All the poisons, however, were not tested on each insect. Their effectiveness was determined by the percentages of mortality obtained, but in some cases the minimum lethal dosages were also estimated. The results showed that sodium and calcium arsenites were the most effective of all the poisons, but as they scorch plants severely, they can only be used in baits or on weeds. Calcium arsenate came next in effectiveness in tests on *Calliptamus*, but against other insects was inferior to Paris green, barium fluosilicate, sodium fluoride or sodium fluosilicate. Sodium fluosilicate was the most effective of the fluorine compounds, but cryolite and barium fluoride also gave promising results. Lead arsenate, which was only tested on *Rhynchites*, was less effective than sodium fluoride or sodium and barium fluosilicates, because the weevils did not feed on it so readily.

Sen (P.). **On the Biology and Morphology of** *Rhabdophaga saliciperda* **Dufour (Cecidomyiidae : Diptera) a common Pest of Willows** (*Salix fragilis*).—*Zool. Jb.* (Anat.) **65** no. 1 pp. 1–36, 3 pls., 8 figs., 60 refs. Jena, 1939. **On the Structures (anatomical and histological) of the full-grown Larva of** *Rhadobphaga saliciperda* **Dufour (Cecidomyiidae : Diptera).**—*T.c.* pp. 37–62, 9 pls., 51 refs.

In the first paper, an account is given of laboratory and field observations in the south of England on the life-history of *Rhabdophaga saliciperda*, Dufour, the larvae of which cause sub-cortical galls of irregular shape, usually fusiform, on the stems and branches of *Salix fragilis*. This Cecidomyiid is widely distributed in the British Isles on species of willow [*cf. R.A.E.*, A **23** 491] and poplar, and has also been recorded from willow in other parts of Europe. All stages, including the four larval instars, are described in detail.

The adults are present in the field from the first half of May until late June [*cf. loc. cit.*], but in the laboratory at ordinary temperatures they often emerged in the first or second week of April. They pair immediately after emergence, and the females deposited 12–57 eggs, generally in the empty larval galleries, since the ovipositor cannot penetrate hard bark. The initial infestation of a tree is considered to be due to the softening of the bark by a fungus that generally follows a heavy frost. Unfertilised females oviposited in the laboratory, but the resulting eggs did not hatch. At 26°C. [78·8°F.], the egg and pupal stages lasted nearly 2 weeks and 2–3 days, respectively. Adults survived for 2–3 days.

Galls are usually formed on trees more than two years old, usually on the internodal region of the branches and towards the base of the twigs. A moderate-sized gall contains about 150 larvae, while a small one may contain as few as nine. In the later stages, the larvae bore in the wood. Owing to the oviposition habits of the female, the galleries of two or three years may be continuous. Infested twigs often die beyond the gall. The larvae overwinter in their galleries and usually pupate at the end of March or the beginning of April ; sometimes they are present as late as June, but such individuals do not apparently complete their development. Counts of laboratory and field populations showed that the ratio of males to females was approximately 2 : 3. *Eurytoma saliciperdae*, Mayr, was frequently observed in the galleries of the Cecidomyiid, but was not actually seen parasitising it.

Control measures that have been suggested include cutting off and burning galled parts of the trees during winter, and applying tar or other adhesive to infested branches to trap the adults as they emerge. The author suggests that a spray of nicotine sulphate would give good control of the eggs in the burrows.

The second paper comprises a detailed account of the internal and external morphology of the full-fed larva of *R. saliciperda*.

Bhatia (M. L.). **Biology, Morphology and Anatomy of Aphidophagous Syrphid Larvae.**—*Parasitology* **31** no. 1 pp. 78–129, 75 figs., 36 refs. London, 1939.

The commonest Syrphids that are predacious in the larval stage on Aphids at Cambridge are *Syrphus luniger*, Mg., *S. ribesii*, L., *S. balteatus*, DeG., *Lasiophthicus* (*Catabomba*) *pyrastri*, L., *Sphaerophoria flavicauda*, Zett., *S. scripta*, L., and *Platychirus scutatus*, Mg. Detailed descriptions are given of the morphology of the egg, the three larval instars and the puparium of *S. luniger*, together with shorter ones of the third-instar larvae and puparia of the other species. The internal anatomy is described of the third-instar larva of *P. scutatus*, which is similar to that of the others, and morphological characters common to the third-instar larvae of all the species under consideration are summarised. In a discussion of the morphological and anatomical characters of the larvae, those that confirm the carnivorous method of feeding and the development of these species from aquatic forms are indicated. In a discussion of the morphology of the pupae, it is stated that no prepupal stage was observed.

The methods of feeding and of progression of the larvae are described. In the field, they fed only on Aphids, but in the laboratory starving larvae preyed on each other, on larvae of other Diptera, such as Cecidomyiids, and on Jassid nymphs. They survived long periods of starvation when provided with water. Females of *S. balteatus* and *S. luniger* laid eggs singly at short intervals, and the egg stage in all species lasted about two days. In laboratory studies on the life-history of *S. luniger*, in which the larvae were kept under conditions as natural as possible, ecdysis, which has not previously been observed in Syrphid larvae, occurred in three larvae 72 hours after hatching, and again 52 hours later ; the puparium was formed 7–8 days after the second moult, and the adult emerged after a further 8 days. The duration of development is, however, influenced by the amount of available food, moisture and temperature. *S. balteatus* pupates anywhere on the stems and leaves of the plants, but the other species seek sheltered sites in which to pupate, *S. flavicauda* and *S. scripta* preferring young leaves, and the others dried leaves or the soil. *P. scutatus* hibernates only in the larval stage, and is commonly found on cabbage and brussels sprouts during November–April, but in the other species, both the larvae and the pupae can overwinter. Each species, except *L. pyrastri*, probably has 3 generations a year. All stages of *S. ribesii*, *S. balteatus*, *S. luniger*, *L. pyrastri* and *P. scutatus* were observed on rose during May–June, and of *L. pyrastri* and *P. scutatus* on plum and thistle, *S. balteatus* and *S. luniger* on mulberry and plum, and *S. flavicauda* and *S. scripta* on cabbage, during July–August. All species except *L. pyrastri* occurred on cabbage and brussels sprouts during September–October, and all except *S. balteatus* were parasitised by Ichneumonids, especially during September–November. *S. flavicauda* was the most frequently attacked. Generally only one parasite occurred in a single host, but 8 were found in a puparium of *S. scripta*.

LUCCHESE (E.). **Contributo alla conoscenza della** *Leskia aurea* **Fall. (Diptera Larvaevoridae Dexiinae).** [A Contribution to the Knowledge of *L. aurea*.]—*Boll. Lab. Zool. Portici* **31** pp. 1–41, 29 figs., 22 refs. Portici, 1938.

All stages are described in detail of *Leskia aurea*, Fall., a Tachinid parasite of the larvae of *Aegeria typhiaeformis*, Bkh., which mine under the bark of apple, quince and pear in the region of Naples [see next abstract]. It was described from Sweden and has also been recorded from France and Italy. Observations on its life-history carried out over 4 years showed that the adults of the overwintered generation emerge between mid-April and the end of May. The eggs are laid in groups of up to 4 on the bark of trees attacked by *A. typhiaeformis*. The larvae hatch a few seconds after oviposition, and seek larvae of the host, which they enter. Several larvae may enter a single host, but only one survives. The process of larval development is described. The puparium is formed close to the remains of the host, and the adults emerge in late June and early July. Larvae of the following generation usually hibernate in the second instar and resume development in mid-February. The pupal stage lasts about a month. About 25 per cent. of the larvae of *Aegeria* found during the winter were parasitised by *L. aurea*. *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.) was bred from puparia of the Tachinid in spring and early summer, and the pupae were attacked by a fungus.

LUCCHESE (E.). **Contributi alla conoscenza dei lepidotteri del melo. II.** *Aegeria typhiaeformis* **Bkh.** [Contributions to the Knowledge of the Lepidoptera infesting Apple. II. *A. typhiaeformis*.]—*Boll. Lab. Zool. Portici* **31** pp. 158–195, 34 figs., 11 refs. Portici, 1939.

In this second paper in a series [*cf. R.A.E.*, A **27** 4], descriptions are given of all stages and the larval mines of *Aegeria typhiaeformis*, Bkh., which infests apple near Naples. It also attacks quince and, very rarely, pear, but not apricot or peach even if they are associated with heavily infested apples. The larvae bore under the bark of the trunk and branches, and though the results of the injury they cause develop slowly, an infested tree eventually becomes prematurely aged and has an irregular, undersized crown. Besides the direct injury, the tunnels afford refuge to other pests and an entrance to injurious fungi. Infestation is, however, likely to become severe only in neglected orchards.

In 1936, 1937 and 1938, the first adults of *A. typhiaeformis* were observed in the first week in May, the average temperatures in April in the 3 years being 15·1, 14·8 and 12·6°C. [59·18, 58·64 and 54·68°F.], respectively. Emergence was intense until mid-June, with a peak at the end of May. A few adults seeking suitable sites for oviposition were observed as late as August. The processes of adult emergence, pairing and oviposition are described. Newly emerged females contained 210–220 eggs in their ovaries. The eggs are laid singly on the bark. In the laboratory, the egg stage lasted up to 12 days in, May at an average temperature of 19°C. [66·2°F.], but was shorter in June. The larvae bored into the bark as soon as they hatched and lived in their mines until the following spring, feeding more or less actively according to temperature. Towards the end of March they formed cocoons and prepared the exit-hole for the adult. As the first pupae were found early in April, the pupal stage presumably lasts about a month. In the laboratory, larvae bored into fruits of apple and survived in them for up to 8 months, but none pupated.

Brief notes are given on the bionomics of the parasites obtained from *A. typhiaeformis*, none of which has previously been recorded from this host. They comprised *Microbracon* (*Bracon*) *triangularis*, Nees, and *Pimpla nucum*, Ratz., both of which are ectophagous parasites of the larvae, *Leskia aurea*, Fall. [see preceding paper], and *Dibrachys affinis*, Masi, which was reared from the pupae of the moth. *D. cavus*, Wlk. (*boucheanus*, Ratz.) was bred from *P. nucum* and from *L. aurea*.

MARIANI (M.). **Nuove specie e forme di lepidotteri di Sicilia ed un nuovo parassita degli agrumi.** [New Species and Forms of Sicilian Lepidoptera and a new Pest of *Citrus*.]—*Giorn. Sci. nat. econ.* **39** no. 3, 13 pp., 1 pl., 1 ref. Palermo, 1937. [Recd. 1939.]

In the course of this paper on Lepidoptera in Sicily, the author states that in 1936 he observed larvae of *Boarmia selenaria dianaria*, Hb., damaging the young shoots of lemon on one estate. This Geometrid usually feeds on *Artemisia*, but with the disappearance of this plant it appears to have become adapted to *Citrus*. It has one generation a year. The larva is briefly described.

GONTARSKI (H.). **Zur Biologie der Schlupfwespe** *Dibrachys cavus* **(Walk.).** [The Biology of *D. cavus*.]—*Z. Morph. Oekol. Tiere* **35** no. 2 pp. 203–220, 12 figs., 26 refs. Berlin, 1939.

The author briefly discusses from the literature the hosts from which *Dibrachys cavus*, Wlk., has been recorded and gives an account of laboratory observations at Frankfurt on its bionomics as a parasite of

Galleria mellonella, L. He describes in detail the processes of pairing, oviposition and larval development. Females oviposit on larvae of the host that have completed their cocoons, and the latter die within 24 hours of oviposition. The functions of the ovipositor in killing the host larvae and in constructing the tubes through which the adult parasites feed on them are discussed at some length. The eggs are laid singly over a period of about 10 days, and from one host cocoon that had been parasitised in the autumn by two females, 77 males and 7 females were obtained. This sex ratio was reversed in the spring.

Adults of the overwintered generation emerged in March–April, and those of the 3 others in mid-June, July and August, respectively. Larvae from adults present in August overwintered in the host. Under favourable conditions, there are probably five generations a year. The author discusses the economic status of *D. cavus*, and concludes that although it has occasionally been recorded as a harmful secondary parasite hindering the control of pests by primary parasites, it is of considerable value in the control of *G. mellonella* in bee-hives.

TISCHLER (W.). **Zur Oekologie der wichtigsten in Deutschland an Getreide schädlichen Pentatomiden. II.** [The Ecology of the most important of the Pentatomids infesting Cereals in Germany. II.]—*Z. Morph. Oekol. Tiere* **35** no. 2 pp. 251–287, 19 figs., 19 refs. Berlin, 1939.

Further observations on the ecology of Pentatomids infesting cereals in Germany were made in 1938 in various localities in East Prussia. The results are given in detail and compared with those obtained in 1937 in Schleswig-Holstein [*R.A.E.*, A **27** 63]. The summer of 1938 was cold and wet and considerably hindered nymphal development. The species observed feeding on the ears of cereals, in addition to those recorded in Schleswig-Holstein [**26** 51], included *Aelia rostrata*, Boh., *A. klugi*, Hahn, *Palomena viridissima*, Poda, *Pentatoma rufipes*, L., and *Eurydema oleraceum*, L.

The bugs overwintered at the edges of forests and in clearings, chiefly in sites with a southerly aspect and with light sandy soil. Preferred sites were covered with *Festuca ovina*, *Poa pratensis*, *Calamagrostis epigeios* and deciduous trees. Lists are given of insects observed overwintering with the Pentatomids in various typical habitats, and it is suggested that in cases of doubt their presence may be taken as indicating also the presence of the Pentatomids.

The infestation of cereals was due to the position of the fields. The bugs did not occur in open and unprotected fields, but the edges of fields sheltered by trees were always infested. Crops on heavy damp soil were not attacked.

All the species had gone into hibernation by the end of October, and they resumed activity at the end of April at a soil temperature of 16°C. [60·8°F.]. Pairing in *Dolycoris* and *Carpocoris* occurred immediately after migration from the winter quarters, and females oviposited at the end of May. Most eggs were laid in June, and some were observed as late as July. The nymphs hatched in mid-June, but development was protracted, and adults were not observed until the end of July and beginning of August. By that time, the rye was being cut.

Laboratory investigations on the effect of temperature and humidity on the various species were carried out in 1937 and 1938, and the results are discussed with special reference to *Eurygaster maura*, L., and *Palomena prasina*, L. The vital optimum for nymphs of *E. maura* was a temperature between 24 and 30°C.[75·2 and 86°F.] and a relative humidity of 80–100 per cent. The eggs were more resistant to both factors than were the nymphs, but were often observed to shrivel up at high temperatures combined with low humidity. The bugs were destroyed by birds, Chrysopids and *Staphylinus caesareus*, Cederh.; Tachinid parasites were the same as in Schleswig-Holstein [**27** 64], except that *Lophosia fasciata*, Mg., was not present. *Microphanurus* (*Telenomus*) *semistriatus*, Nees, was bred from about 10 per cent. of the eggs of *Dolycoris baccarum*, L., and *Carpocoris pudicus fuscispinus*, Boh. Lists are appended of the plants preferred by *Dolycoris* and *Carpocoris* for maturation feeding and for oviposition. The former deposited 80 per cent. of its eggs on *Hieracium pilosella* and 13·2 per cent. on *Geum rivale*, whereas *Carpocoris* deposited only 41·6 per cent. on *H. pilosella* and an approximately equal percentage on Graminaceae.

NIXON (G. E. J.). **Parasites of Hemipterous Grain-pests (Hymenoptera: Proctotrupoidea).**—*Arb. morph. taxon. Ent. Berl.* **6** no. 2 pp. 129–136, 3 figs., 4 refs. Berlin, 1939.

Descriptions are given of five species of Scelionids reared in 1937 and 1938 from the eggs of Pentatomids attacking cereals in Schleswig-Holstein and East Prussia [*cf.* preceding paper, etc.]. They comprise *Telenomus tischleri*, sp. n., from *Dolycoris baccarum*, L., *Microphanurus choaspes*, sp. n., and *M. anitus*, sp. n., both from *Aelia acuminata*, L., *M. cultratus*, Mayr, from *Carpocoris pudicus*, Poda, and *M. semistriatus*, Nees, from *C. pudicus*, *Palomena prasina*, L., and *Eurygaster maura*, L. *M. semistriatus* is also recorded from eggs of *Troilus luridus*, L., in Germany and in England.

A key separating the four species of *Microphanurus* dealt with is included.

NIKLAS (O. F.). **Beitrag zur Biologie des Birnenknospenstechers** (*Anthonomus pyri* **Koll.**). [A Contribution to the Biology of the Pear Blossom Weevil, *A. piri*, Koll.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 2 pp. 97–119, 4 figs., 2 pp. refs. Berlin, 1939.

An account is given of field and laboratory investigations carried out in the neighbourhood of Berlin in 1937–38 on the life-history of *Anthonomus piri*, Koll., on pear, which was almost the only food-plant of the weevil in this district, and the data obtained are compared with those in the literature [*cf. R.A.E.*, A **26** 761]. *A. spilotus*, Redt., was not found near Berlin [*cf.* **26** 762].

Pairing and oviposition occur after the adults leave their aestivation quarters, about mid-August. The position of the oviposition and feeding punctures on the leaf buds and fruit buds of pear is described. Oviposition occurred from September to late November, with a peak in October, and females deposited an average of about 20 eggs in the upper part of the fruit buds, rarely in the leaf buds. During the oviposition period, the females fed first on the leaves, and when these had fallen, on the leaf buds, and they were able to fly from tree to tree. They sought shelter at the onset of frosts on trunks and branches, but none survived the winter. In February, only dead adults were observed, and no oviposition took place in the spring.

The embryo was completely developed a few weeks after oviposition, but hatching did not begin until the end of February. Records are tabulated of the dates of occurrence near Berlin of the eggs, the three larval instars, and the pupae. The larvae feed in the buds and pupate in them in May. In the meantime, the infested buds wither, and usually drop to the ground. The adults emerged in about 3 weeks, and fed for about a month on pear leaves ; plum and peach were accepted in the absence of pear, but mortality was greater on them. Aestivation began in early July and occurred in sheltered places on the trunk, preferably the lower part, and larger branches of pear. In heavily infested districts, the number of aestivating adults is proportional to the degree of roughness of the bark. It was found that the dates when the weevils enter and leave their aestivation quarters can be best ascertained by spraying with a proprietary insecticide that excites the weevils, causing them to come out of their refuges, and then kills them before they can escape.

PROFFT (J.). **Ueber Fluggewohnheiten der Blattläuse im Zusammenhang mit der Verbreitung von Kartoffelvirosen.** [On the Flight Habits of Aphids in Connection with the Spread of Potato Viruses.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 2 pp. 119–145, 6 figs., 26 refs. Berlin, 1939.

The author briefly reviews the work of Davies and Whitehead on migration in *Myzus* (*Myzodes*) *persicae*, Sulz. [*R.A.E.*, A **24** 61, 551 ; **26** 379, 709], which in Germany hibernates mainly on peach and migrates each year to potato fields, where it transmits virus diseases [**27** 157], and gives an account of observations and experiments in Pomerania on flight in this and other Aphids that infest potato.

Boards covered with an adhesive were used in 1937 and 1938 to ascertain the effects of wind on flight and the height at which it occurs. Wind of even slight velocity influenced flight and with wind speeds of over 3 metres per second [6·7 miles per hour], the windward side of the boards caught more Aphids than the other. Strong winds were able to blow away both winged and wingless individuals and to carry them far. This does not contradict the statement that flight ceases with a wind speed of 3·75 miles per hour [**24** 552], because the air may be fairly still around the lower parts of a potato plant and Aphids flying about them may be caught by currents higher up. Winds from all directions, including the moist north-westerly ones, carry winged Aphids. In consequence, the direction of spread of viruses transmitted by Aphids should agree with the monthly main wind direction. Catches on trap boards at heights between 4 ins. and 9 ft. above the ground and analyses of the food of birds, which are quoted from the literature, indicate that winged Aphids may be regarded as " aerial plankton " [**19** 634, etc.].

In investigations on the sense of smell in Aphids, tobacco plants just brought out of a greenhouse were heavily infested in a few hours by various winged Aphids, mostly *M. persicae*, *Aphis* (*Doralis*) *rhamni*, Boy., and *A.* (*D.*) *frangulae*, Koch. Young potato plants proved more attractive than older ones, but only to the above three species, and *Macrosiphum solanifolii*, Ashm., and *M. solani*, Kalt. (*Aulacorthum pseudosolani*, Theo.), which regularly infest potato in summer. Aphids can therefore reach the plants by flight guided by smell, unless prevented by too strong a wind.

Winged Aphids infested all the potato plants in a field fairly uniformly and were not concentrated at the edges. Potato fields sheltered from the wind had a distinctly larger Aphid population than those in exposed situations. Virus transmission is therefore more probable in sheltered fields, particularly as flights at brief intervals can be made there undisturbed, and valuable plantings should be placed on exposed heights. In experiments in which potato plants were grown in beds 2 ft. square in fields of winter rye 6 ft. high, they soon became infested by *A. frangulae*. The isolation of plants is thus inadequate as a protection against virus infection, and furthermore the microclimate in such conditions favours the Aphids. At the most, protection is afforded against wingless Aphids.

SELLKE (K.). **Versuche mit chemischen Mitteln zur Bekämpfung des Kartoffelkäfers** (*Leptinotarsa decemlineata* **Say**). [Experiments with chemical Insecticides against the Potato Beetle.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 2 pp. 146–171, 16 figs., 13 refs. Berlin, 1939.

Experiments with 21 German preparations against *Leptinotarsa decemlineata*, Say, on potato were carried out at Ahun (Creuse) in the summer of 1938. They were made on third- and fourth-instar larvae and adults in the laboratory, and the results were confirmed by small-scale tests in the field.

Of the 10 arsenicals tested, the most effective against the larvae were two sprays of calcium arsenate, which each gave 99 per cent. mortality (comparable with a much used French lead arsenate giving 98 per cent.) and a dust of lead arsenate, which gave 92 per cent. The adults were more resistant than the larvae. The calcium arsenates again proved the most effective, the best being a dust (93 per cent. mortality), followed by three sprays (91, 83 and 85 per cent.). Adults that had hibernated were generally more resistant to arsenicals than those of the summer generation, and fourth-instar larvae about to pupate were more resistant than younger ones. The content in water-soluble arsenic pentoxide in preparations of calcium arsenate had no effect on their toxic action, and neither the calcium nor the lead arsenates caused any scorching of foliage. The addition to the calcium arsenate sprays of a mixture of magnesium sulphate and lime [*cf. R.A.E.*, A **25** 764] did not increase their insecticidal action. The mixture itself had no effect on larvae or adults fed on leaves sprayed with it.

Of the contact poisons tested, the most effective were a dust of derris and one containing a mixture of derris and pyrethrum, which both gave complete mortality within a short time of larvae and of adults that had hibernated, even when mixed with an equal quantity of talc. Both were effective in the field. Complete mortality of adults of the summer generation was not obtained, and mature fourth-instar larvae were more resistant than younger ones. The derris dust, diluted or undiluted, was still effective against larvae after exposure to rain.

Barnes (H. F.). **Grass-seed *Dasyneura* Gall Midges, together with Descriptions of two new Species.**—*Arb. physiol. angew. Ent. Berl.* **6** no. 2 pp. 171–175, 11 refs. Berlin, 1939.

Six Cecidomyiids of the genus *Dasyneura*, including two new ones, cause injury to grass seed in various parts of the world. They are *D. airae*, Kieff., which was described from *Aira flexuosa* in Lorraine; *D. alopecuri*, Reut., which is a widely distributed pest of *Alopecurus pratensis* [*R.A.E.*, A **18** 501; **24** 796, etc.]; *D. dactylidis*, Metcalfe, which was described from *Dactylis glomerata* in England [**21** 368]; *D. graminis*, Felt, which was described from red-top grass [*Agrostis vulgaris*] in New York and is believed by the author to have been reared from bent grass (*Agrostis*) in England; *D. festucae*, sp. n., on creeping red fescue (*Festuca rubra* var. *arenaria*) in England; and *D. triseti*, sp. n., on yellow oat grass (*Trisetum flavescens*) in the Austrian Alps [see next abstract]. Descriptions are given of both sexes of the new species.

Watzl (O.). **Studien über Entwicklung und Lebenslauf der Goldhavermücke, eines alpinen Grassamenschädlings.** [Studies on the Development and Life-history of an Alpine Pest of the Seed of Yellow Oat Grass.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 2 pp. 176-189, 7 figs. Berlin, 1939.

Descriptions are given of all stages of *Dasyneura triseti*, Barnes [*cf.* preceding abstract], which infests the seeds of yellow oat grass (*Trisetum flavescens*) in the Austrian Tyrol. It has 2 generations a year, and the larvae pupate in the soil. The egg stage lasted about 8 days in August, and the larval feeding period about 3 weeks in June and 2 in August and September. The winter is passed in the larval stage in the soil. Females oviposit in young ears, the number of eggs in a single ear usually not exceeding 4, but in exceptional cases ranging up to 20. A Scelionid of the genus *Inostemma* was bred from the pupae. The abundance of this Cecidomyiid is chiefly due to the coincidence of its two flight periods with the formation of the young ears. The percentage infestation of seed from the two crops averages about 10 and 25, respectively.

Frey (W.). **Ueber die Wirksamkeit von Naphthalin, Paradichlorbenzol und Hexachloräthan als Kleidermottenbekämpfungsmittel.** [On the Effectiveness of Naphthalene, Paradichlorobenzene and Hexachlorethane against the Clothes Moth.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 2 pp. 189–198, 2 figs., 13 refs. Berlin, 1939.

Naphthalene, paradichlorobenzene and hexachlorethane, singly or in combination, are the basis of most commercial powders used against *Tineola bisselliella*, Humm. The literature on their value as fumigants against this moth and their physical and chemical characters are briefly reviewed, and an account is given of tests of their insecticidal effect on eggs, larvae and adults, which were exposed on pieces of felt or wool in air-tight containers and kept under observation on fresh pieces for some time after fumigation.

The results obtained, which are discussed in detail, showed that paradichlorobenzene is the best fumigant for rapid disinfestation, though the other two, which evaporate more slowly, might be effective in the case of articles stored for a long period in air-tight containers. At a temperature of 20°C. [68°F.], an exposure of 4 days, and a rate of application equivalent to 15 oz. per 100 cu. ft., paradichlorobenzene gave 100 per cent. mortality of larvae at the end of the fumigation period, while naphthalene crystals and hexachlorethane gave 40 and 0 per cent. after 15 days. There was little difference in effectiveness between naphthalene flakes and crystals, but naphthalene balls were inferior. When the temperature was raised to 22°C. [71·6°F.], the fumigation period to 2 weeks, and the rate of application to 1 lb. per 100 cu. ft., hexachlorethane gave 100 per cent. mortality after a week. At the same temperature and rate of application, but with an exposure of 1 day, the percentage mortality of adults was 100 one day after fumigation with paradichlorobenzene or hexachlorethane, but only on the fifth day after fumigation with naphthalene.

The percentage mortalities of eggs exposed for 4 days at 22°C. were 100 with paradichlorobenzene, 99·6 with fine naphthalene crystals, and 37·9 with hexachlorethane, all at the rate of 15 oz. per 100 cu. ft. Complete mortality of the eggs was given by 8 days' fumigation at 20°C. with hexachlorethane at the same rate of application.

HEINZE (K.) & PROFFT (J.). **Ueber Psylliden und Psyllidenschäden an der Kartoffel.** [On Psyllids and Injury to Potato by them.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 2 pp. 198–208, 3 figs., 15 refs. Berlin, 1939.

In connection with work in Germany on the transmission of virus diseases of potato by insects, investigations were made in Berlin and eastern Pomerania on Psyllids that infest potato. Of the species that feed temporarily on potato, *Rhinocola aceris*, L., was the commonest in Pomerania, where *Psylla mali*, Schm., and *Aphalara calthae*, L., also occurred. *Psylla peregrina*, Frst., was observed near Berlin. The most important species, however, was *Trioza nigricornis*, Frst., which breeds on potato. All stages are briefly described, and a list is given of the plants on which eggs and nymphs were observed. Its principal food-plants were potato and varieties of cabbage. Little is known of its life-history. The egg stage is believed to last about a fortnight, and the nymphal stage lasted 32–33 days in September at a room temperature of 15–18°C. [59–64·4°F.]. There were at least three generations a year in northern and central Germany ; nymphs were most abundant from May to early June, from the end of June to the end of July, and in August–September. Hibernation takes place in the adult stage.

Cage experiments were made in Berlin to ascertain whether nymphs and adults of *T. nigricornis* transmit potato virus diseases (leaf roll, X and Y) or whether they cause injury to the plants through a toxic action of the saliva. No transmission of the viruses occurred. Leaves infested by a large number of nymphs showed slight curling, light-coloured spots, and, on the underside, red discolorations. No symptoms were caused by adult feeding, and tubers from plants injured by the Psyllid gave rise to plants that showed no symptoms.

MASSEE (A. M.). **A Species of Gall-mite (Eriophyidae) injurious to Tomato.**—*Ann. Mag. nat. Hist.* (11) **3** no. 18 pp. 617–619. London, 1939.

A description is given of the gall-mite, *Eriophyes lycopersici*, sp. n., which is a serious pest of tomato in Morocco. It infests the aerial parts of the plants, including the young fruits, and causes whitish discoloration, abnormal growth of hairs and stunting. Dusting with sulphur is said to check the spread of the mite, but treatments should be regular to be effective.

Use of Locust Bait. Some Amendments to Previous Suggestions.—*Rhod. agric. J.* **36** no. 3 pp. 236–237. Salisbury, S. Rhod., 1939.

Recent experience with the sodium arsenite baits recommended for the control of hoppers of the red locust [*Nomadacris septemfasciata*, Serv.] in Southern Rhodesia [*R.A.E.*, A **26** 410] has shown that the amount of water to be added to 100 lb. of dry bait should be increased to 12 gallons or more. This quantity of water tends to cause the formation of lumps, which should be broken up by hand. As much bait as possible should be made to adhere to the plants, as it is not so effective on the ground. It is important to apply the bait to the foliage round the feeding ground, as well as in it, especially when the swarm is dense. It should be applied against large swarms as soon as hatching begins, but small ones should be left until the hoppers are feeding freely, unless they can be easily seen.

Mossop (M. C.). **Fumigation with Hydrocyanic Acid Gas.**—*Rhod. agric. J.* **36** nos. 3–4 pp. 220–235, 317–329, 2 figs., also *Bull. Minist. Agric.* [*S. Rhod.*] no. 1105, 29 pp., 2 figs. Salisbury, S. Rhod., 1939.

In this account of methods of using hydrocyanic acid gas for fumigating stored products, warehouses, rooms, living plants (other than by tent fumigation), and the burrows of rodents, a brief survey of the properties of the gas and the materials producing it is followed by instructions for its application in various ways and for the calculation of the volume of the enclosed space. A table is given showing the dosages of sodium cyanide and the exposures necessary for control of a variety of pests, and the precautions to be observed during and after fumigation are described.

Frappa (C.). **Note sur une nouvelle espèce d'aleurode nuisible aux plantations de tabac de la Tsiribihina.**—*Bull. écon. Madagascar* N.S. no. 16 (1938 no. 4) pp. 254–259, 20 refs. Tananarive, 1939.

The author summarises the original description of the Aleurodid genus *Bemisia*, gives a list of the 16 species hitherto known, with notes on their distribution and in most cases food-plants, and describes the adult and larva of *Bemisia vayssierei*, sp. n., which was taken on tobacco in Madagascar in 1938. Characters are given distinguishing the new species from *B. manihotis*, Frappa [*R.A.E.*, A **26** 413] and *B. longispina*, Priesn. & Hosny [**22** 710], the latter being the species with which it is most closely allied. It was abundant on the leaves of tobacco in a river valley in August, and infested leaves showed a condition resembling that caused by the virus disease of tobacco known as crinkle or leaf-curl, which is transmitted by *Bemisia* in the Netherlands Indies [**20** 381] and various parts of Africa [**23** 692, etc.] and which the author proposes to call aleurodiosis.

Fernando (M.). **The Sources of *Ephestia* Infestation of stored Cacao in Ceylon.**—*Trop. Agriculturist* **92** no. 3 pp. 141–155, 14 refs. Peradeniya, 1939.

The insects attacking stored cacao in Ceylon include *Ephestia elutella*, Hb., *E. cautella*, Wlk., *Corcyra cephalonica*, Stn., and *Araecerus fasciculatus*, DeG. The larvae of *Ephestia*, which are the most important of these pests, cannot penetrate the hard shells of fermented beans, but attack those that are cracked or broken [*R.A.E.*, A **21** 296], or that have been damaged by *A. fasciculatus*. The incubation, larval, and pupal periods of *E. elutella* have been estimated by J. C. Hutson to last 5–9 days, 8–10 weeks and 9–12 days, respectively, under tropical conditions.

In view of the persistent infestation of cacao beans arriving in London from various countries [*cf.* **18** 174], investigations were carried out in 1936–37 in Ceylon on the sources of the infestation by *Ephestia* of cacao there. The method adopted consisted in selecting, at various dates after picking, two lots of about 1 cwt. cracked and broken beans from one or more drying floors belonging to small-holders and two from those belonging to large estates, withdrawing a 7 lb. sample from each lot, sterilising the remainder by exposure to dry heat at 150°F., subjecting it to the routine storage and transport usual for estate cacao, and at selected stages in the process withdrawing further samples and sterilising the remainder. All the samples were forwarded to London for examination. It is agreed that the results thus obtained would be an under-estimate in the case of small-holders' cacao, which is handled by a large number of dealers prior to export. The results showed that the drying floors were apparently free from *Ephestia*, possibly, in the case of small holdings where the beans are dried in the sun, on account of the negative phototropism of the larvae and adults, and in the case of estates, because the high temperatures of the drying lofts inhibit development or deter oviposition. Since the cacao from one estate was slightly attacked in the estate stores (0·3 per cent. damage), that from small holdings during drying or storage by the local dealer, and all of it in the exporters' warehouse, all later stages of storage are suspected sources of infestation. There was no evidence of infestation during transfer from one store to another.

Both *E. elutella* and *E. cautella* were obtained from cacao during these investigations, and it is suggested that the latter is more destructive to cacao in Ceylon than was formerly believed [*cf.* **23** 593].

To reduce infestation, it is recommended that cacao should not be stored longer than is essential, and that warehouses should be kept scrupulously clean, light and well-ventilated, and have cement floors [*cf.* **21** 296]. Possible measures of control, after the cacao has become infested, are discussed from the literature.

Backhouse (J. R. C.). **A Note on the Coconut Caterpillar in the Batticaloa District.**—*Trop. Agriculturist* **92** no. 3 pp. 163–164. Peradeniya, 1939.

The author briefly reviews the measures taken for the control of the coconut caterpillar [*Nephantis serinopa*, Meyr.] from 1921 to 1937, in the Batticaloa district of Ceylon [*R.A.E.*, A **21** 574; **24** 765; **26** 359], where a severe outbreak of this Tineid causes the loss of a large part of the coconut crop for 2 years. In 1938, the introduced parasite, *Trichospilus pupivora*, Ferrière, was liberated in the district in much larger numbers than before, and it is hoped that it will become acclimatised. It is considered that it is already helping the indigenous parasites to control the Tineid.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **50** pt. 4 pp. 204–207, 6 figs. Sydney, 1939.

This part of a series on insect pests in New South Wales [*cf.* *R.A.E.*, A **27** 602] includes notes on *Hymenia recurvalis*, F., the larvae of which were numerous on a common weed of the genus *Amarantus* in the Sydney district in the season 1938–39. Though this appears to be its preferred food-plant in New South Wales, the Pyralid has been recorded there as attacking silver beet and causing injury to saltbush [*Atriplex*]. If it becomes a pest of beet, as it is in other parts of the world, it could be controlled by cutting and burning *Amarantus* near beet crops, and, if necessary, by dusting or spraying with lead arsenate. Sprayed beet foliage should later be cut off and destroyed.

Helson (G. A. H.). **The Oriental Peach Moth** (*Cydia molesta* **Busck**) **Investigations in the Goulburn Valley, Victoria. Progress Report for the Seasons 1935–38.**—*Pamphl. Coun. sci. industr. Res. Aust.* no. 88, 23 pp., 1 graph, 1 map, 11 refs. Melbourne, 1939.

Details are given of investigations in 1935–38 on the life-history and control of *Cydia molesta*, Busck, on peach in the Goulburn Valley, Victoria, the main results of which have already been noticed from annual reports [*R.A.E.*, A **25** 320; **26** 448; **27** 544]. Rearing in the laboratory and catches of adults in the field showed that the moth has 5 generations a year in this district, and 6 in favourable seasons. The length of the various stages in different generations is shown in a table. The relation between temperature and the population density during the seasons under survey is discussed, and it is concluded that neither the abundance of the overwintering larvae nor the rate of increase of the population during the season is a reliable indicator of the amount of damage to be expected to late canning peaches.

Laboratory and field tests on control were made with a large number of insecticides [*cf. locc. citt.*], but the control afforded was not statistically significant and did not justify the expense involved. In tests in 1936 with bands applied to the trees in February and left until towards the end of the winter, the average numbers of larvae trapped by bands of corrugated cardboard treated with beta-naphthol, similar bands one-half of which were treated with beta-naphthol, and hessian bands were 13·8, 12·5 and 10, respectively. The numbers of larvae trapped in untreated corrugated cardboard bands averaged only 8·6, but they were more accessible and so were much more heavily parasitised by the Pteromalid, *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.) than those in hessian bands. In 1937, bands treated with beta-naphthol and 3 chlorinated naphthalenes, gave percentage mortalities of 100, 98·5, 77·7 and 11·6 per cent., respectively. In calculating these figures allowance was made for natural mortality, based on that due to causes other than parasitism in larvae in untreated bands. Fruits infested by *C. molesta* frequently drop before they are mature, and the larvae then spin their cocoons in detritus on the ground; the destruction of such fallen fruits and of those left on the trees after harvest is recommended.

Owing to the comparative failure of insecticides to give control of the moth, increased attention is being devoted to the possibilities of its biological control. Native parasites of *C. molesta* in Victoria and New South Wales are *D. cavus*, *Chromocryptus antipodialis*, Ashm., *Gambrus stokesi*, Cam., *Stomatoceras* (*Anthrocephalus*) *pomonellae*, Cam., a Bethylid of the genus *Perisierola*, and an unidentified Eulophid, while in Victoria it is also parasitised by two Ichneumonids of the genera *Bassus* and *Angitia* (*Inareolata*), respectively, and an unidentified Braconid. In the Goulburn Valley, the most important of these is *D. cavus* [**23** 726], followed by *C. antipodialis*, which it also parasitises heavily. The most important in New South Wales, chiefly in the Sydney district, are *S. pomonellae* [**27** 293], *G. stokesi* and *Perisierola* sp. The other species are rare. Since *D. cavus* parasitises only larvae of the overwintering generation, it was thought desirable to introduce a parasite that was active in spring and summer. Five were introduced from the United States and liberated [**26** 448 ; **27** 544]. Some recoveries were made, but the only one thought to have survived the winter in the field is *Macrocentrus ancylivorus*, Rohw. Further shipments of this Braconid are to be made. Like *C. antipodialis*, it is itself parasitised by *D. cavus*.

BACK (E. A.). **House Insulation and Insect Infestations.**—*Proc. ent. Soc. Wash.* **41** no. 4 pp. 129–136, 10 figs. Washington, D.C., 1939.

From an examination, extending over 10 years, of material used in building construction in the United States for insulation against heat, cold or sound, it is concluded that any material containing animal matter, particularly wool refuse and cow-hair, may sooner or later harbour insects, even though guaranteed to have been treated to render it insect-proof. Instances are given of such material being found heavily infested by *Tineola bisselliella*, Humm., *Attagenus piceus*, Ol., and *Anthrenus vorax*, Waterh., and in one case moderately infested by the Ptinid, *Mezium americanum*, Lap. The application of tarred paper to the top and bottom of insulation pads was not an effective deterrent. Vegetable fibres, such as flax and jute, have not been found infested with these species, but mixtures of these fibres with as little as 10 per cent. matter of animal origin are readily attacked. It is probable that Psocids thrive in insulating matter of vegetable origin, particularly if it becomes damp. Infestations by *Tribolium castaneum*, Hbst., have been observed in insulations of cottonseed hulls, and *Dermestes lardarius*, L., burrowed into the walls of a house where coarse vegetable fibre had been used, but such an attack is accidental. The increase of *Lepisma* is encouraged by the use of unpoisoned flour pastes in applying asbestos insulations to heating systems. Insulations consisting entirely of mineral substances are not in themselves capable of supporting insect life, but are often found apparently infested by individuals of *Tineola*, *Attagenus* and *Anthrenus* that retreat into them to rest, moult or pupate. An active infestation might possibly be maintained in this way as these insects can mature by feeding on the dead of their own species. Moreover, the habit sometimes contributes to the failure of fumigation of rooms to give entire satisfaction.

Lever (R. J. A. W.). **Vegetable Garden Pests and their Control.**—*Agric. J. Fiji* **10** no. 1 pp. 11–17, 1 map. Suva, 1939.

The principal Lepidopterous pests of vegetables in Fiji are: *Prodenia litura*, F., *Plusia* (*Phytometra*) *chalcites*, Esp., and *Heliothis armigera*, Hb. (*obsoleta*, F.), on cabbage and tomato; *Plutella maculipennis*, Curt., *Crocidolomia binotalis*, Zell., and *Hellula undalis*, F., on cabbage; *Margaronia indica*, Saund., on cucumber and pumpkin; *Draecenura pelochra*, Meyr., *Maruca testulalis*, Geyer, *Argyroploce illepida*, Btlr., and *Zizera* (*Zizina*) *labradus*, Godt., var. *mangoensis*, Btlr., on beans; *Hymenia recurvalis*, F. (*fascialis*, Stoll), on beet and *Amarantus*; *Doleschallia bisaltide*, Cram., on *Eranthemum*; and *Sylepta derogata*, F., on *Hibiscus*. The adults of most of them are very briefly described. Other pests of garden plants include *Ceratia* (*Aulacophora*) *coffeae*, Hrnst., and *C.* (*A.*) *quadrimaculata*, Chap., on cucumber and pumpkin; *Epilachna vigintioctopunctata*, F., on cucumber, tomato, egg-plant [*Solanum melongena*] and *Physalus peruviana*; *Aphis maidis*, Fitch, on maize; *Leptoglossus australis*, F., on pumpkin; *Mictis profana*, F., on rose, *Cassia* and *Citrus*; and *Eriophyes hibisci*, Nal., on *Hibiscus*. Adults of *Adoretus versutus*, Har., were reported to be attacking the leaves of beans in Ra Province in 1937.

Brief suggestions are made for the control of the various kinds of pests recorded.

Lever (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **10** no. 1 pp. 17–20, 4 figs., 8 refs. Suva, 1939.

Recent investigations on *Xyleborus morstatti*, Hag., which infests avocado [*Persea gratissima*] in Viti Levu [*cf. R.A.E.*, A **26** 497], have shown that a complete gallery may contain up to 26 individuals of this Scolytid, including larvae, pupae and adults, and that the injury may be extensive enough to kill the tree. Avocado is also attacked by *Icerya seychellarum*, Westw., in Fiji.

The three termites commonly found in timber in these islands are *Coptotermes* (?) *acinaciformis*, Frogg. [**27** 212], *Calotermes buxtoni*, Hill, which was recorded from a building in Suva in 1932, and *Calotermes repandus*, Hill, which is the usual species in houses and which was responsible for extensive damage in Suva in 1938. The other termites recorded in Fiji are *Eutermes olidus*, Hill, a jungle species, *Calotermes taveuniensis*, Hill, recorded from Taveuni Island in 1924, and *Prorhinotermes inopinatus*, Silv., which often attacks damp wood.

Adults of the Eulophid parasite of *Promecotheca*, *Pleurotropis parvulus*, Ferrière, recently shipped from Suva to Tonga [**27** 366], were successfully kept alive during the voyage of 26 days on raisins sewn to strips of cardboard, previous experience having shown that refrigeration for so long a period or the provision of drops of honey as food were both unsatisfactory.

The introduced toad, *Bufo marinus*, has been observed to devour large numbers of house cockroaches in Suva, and cutworms, probably *Cirphis unipuncta*, Haw., in rice-fields in another part of Viti Levu.

In February 1939, a consignment of the predacious Carabid, *Catascopus fascialis*, Wied., was dispatched by air-mail from Malaya to Australia and thence by ship to Samoa, for liberation against *Oryctes rhinoceros*, L., which causes serious damage to coconut there. The beetles were fed and cared for when the ship called at Auckland

and again at Suva, where the sphagnum moss was moistened, ants were killed and adhesive applied to prevent any further invasion. In the laboratory, two individuals eviscerated cutworms, killed house-flies and even attacked *Leptocorisa* sp.

McCLEAN (H. C.) & WEBER (A. L.). **Effect of Insect Residues and other Factors on Removal of Spray Residues from Apples.**—*J. econ. Ent.* **32** no. 3 pp. 357–360, 2 refs. Menasha, Wis., 1939.

It was observed in New Jersey that it was more difficult to remove spray residues from apples that had been infested by leafhoppers late in the season, because the residue in the stem cavities became coated with honey-dew infected by a fungus that formed a heavy black deposit of organic substances. Tests of the lead residue on apples sprayed with acid lead arsenate, with and without organic deposit, showed that there was little difference in the total spray residue in the two cases, that washing in a solution of hydrochloric acid and a wetting agent at 70°F. removed 50 and 80 per cent. of the lead, respectively, and that only the contents of the stem cavity were affected. Washing at 90°F. removed almost all the lead residues. The removal of spray residue was also more difficult in the case of trees with light foliage, owing possibly to excessive wax-formation. It has been shown that the removal of lead and arsenic residues is more difficult when spreaders containing casein have been used [*cf. R.A.E.*, A **22** 283]. In tests, a number of newly developed mixtures containing no casein were found to be good spreaders, but did not allow the build-up of a heavy deposit of lead arsenate. One proprietary spreader, however, gave heavy and uniform deposits and good retention of lead arsenate, and the residue was easily removed by washing.

ENGLISH (L. L.). **The Toxicity of Derris to Larvae of the Citrus Whitefly.**—*J. econ. Ent.* **32** no. 3 pp. 360–363, 6 figs, 2 refs. Menasha, Wis., 1939.

An account is given of experiments in Alabama to test the toxicity to larvae of *Dialeurodes citri*, Ril. & How., on leaves of *Citrus* of derris (containing 5 per cent. rotenone) in dilute emulsions of 83 viscosity white oil. When the oil was emulsified with powdered skim milk, diglycol laurate, a proprietary soap and triethanolamine oleate, the emulsions were effective in the order named and inversely to their stability. Further tests of emulsions made with powdered skim milk and with diglycol laurate, with and without derris (1 : 1,000), showed that the emulsions with the skim milk were again the most effective, and that a considerable proportion of the kill obtained with them was due to the action of the oil. Emulsions prepared with sodium oleyl sulphate and diglycol oleate were more effective as supplements to derris than one made with diglycol laurate. In view of the possibility that the increased efficiency of the oil emulsions when derris was added to them was due to the effect of the derris on the physical properties of the emulsions rather than to its toxicity, tests were made of extracted and unextracted derris at concentrations of 1, 2 and 4 parts per 1,000 with diglycol laurate and emulsions of white oil with diglycol laurate or skim milk. The efficiency of all the sprays containing unextracted derris increased with its concentration, but that of the emulsions containing extracted derris was reduced when the concentration was 4 : 1,000. This shows that derris itself had a true toxic action, while it might be physically antagonistic to the insecticidal action of dilute emulsions.

TSAI YU HSIAO & MOTE (D. C.). **The Cherry Casebearer, *Coleophora pruniella* Clem., in Oregon.**—*J. econ. Ent.* **32** no. 3 pp. 363–365. Menasha, Wis., 1939.

An account is given of the life-history of *Coleophora pruniella*, Clem., on apple and cherry in Oregon, where it was first observed in the spring of 1937 and has one generation a year. *Microbracon pygmaeus*, Prov., and the Pteromalid, *Eurydinota lividicorpus*, Gir., were reared from the larvae.

STEINER (L. F.) & FAHEY (J. E.). **The Effects of Neutral Copper Fungicides on Tank-mix Nicotine-Bentonite in Control of the Codling Moth.**—*J. econ. Ent.* **32** no. 3 pp. 365–369, 1 fig., 4 refs. Menasha, Wis., 1939.

Since fungicides are necessary in summer in apple orchards in the mid-western United States, and alkaline fungicides have proved to be incompatible with fixed nicotine sprays used against larvae of the codling moth [*Cydia pomonella*, L.], tests were made in southern Indiana in 1938 with five neutral copper compounds added to a tank mixture of nicotine sulphate, Wyoming bentonite, soy-bean oil and sodium lauryl sulphate [*cf. R.A.E.*, A **26** 732]. Several cover sprays were made with each combination. All the fungicides reduced the effectiveness of the spray against *C. pomonella* and the resistance of the nicotine deposit to weathering by heavy rains, and at least one of them reduced the toxicity of the nicotine deposit. All caused very severe foliage injury, and two used early in the season damaged the fruit. Foliage injury from copper, however, was caused in 1938 by applications of weak Bordeaux mixture with lead arsenate.

NELSON (O. A.). **Preparation of Calcium Arsenates of low Solubility.**—*J. econ. Ent.* **32** no. 3 pp. 370–372, 1 fig., 7 refs. Menasha, Wis., 1939.

The author describes a method of preparing calcium arsenate in which a dilute solution of arsenic pentoxide is atomised into a suspension of hydrated lime with vigorous stirring. Localised conditions favouring the formation of particles having a core of the soluble dicalcium arsenate are avoided, and the calcium arsenate obtained is uniform in composition, basicity and content of soluble arsenic pentoxide. Calcium arsenates of any desired composition, up to a molar $CaO : As_2O_5$ ratio of approximately 3·8 : 1, can be prepared by adjusting the ratio of the reacting substances.

DOZIER (H. L.). **New Method of using Paradichlorobenzene for Seed Treatment to control Sweetpotato Weevil.**—*J. econ. Ent.* **32** no. 3 pp. 372–373. Menasha, Wis., 1939.

A method of volatilising paradichlorobenzene applied to seed tubers of sweet potato for the control of *Cylas formicarius*, F., in

Louisiana reduced the period required for fumigation, and the loss from decay and retarded germination. By the use of an electric vacuum cleaner, the paradichlorobenzene was volatilised in 6–15 minutes at room temperatures. Fumigation at the rate of 3–9 oz. crystals per bushel of tubers in barrels gave 79·63–100 per cent. mortality of adults, larvae and pupae in 16·5–27 days between 20th February and 9th March and 100 per cent. in 13 days in April, whereas in untreated infested tubers kept under the same conditions from 20th February to 26th May there was hardly any mortality. The adults were the least, and the larvae the most, resistant to fumigation.

LANGSTON (J. M.). **Life History Notes on the Cowpea Curculio,** *Chalcodermus aeneus* **Boh.**—*J. econ. Ent.* **32** no. 3 pp. 374–377, 1 fig., 5 refs. Menasha, Wis., 1939.

Chalcodermus aeneus, Boh., is widely distributed on cowpeas (*Vigna sinensis*) in Mississippi. In life-history studies in 1934–37, the overwintered adults emerged in spring before the cowpea pods were available. A list of the plants on which they fed is given [*cf. R.A.E.*, A **27** 82]. Oviposition by females of the overwintered generation began as soon as the pods were large enough and continued until late September or early October. In cages, however, eggs laid in autumn did not give rise to adults unless they had been laid by females reared in the same year. Adults of the first generation began to emerge 20–30 days after oviposition, and in cages females began to deposit eggs 10 days later and continued until the end of September or the middle of October. Adults of the second generation emerged in 20 or more days. In 1936, when conditions were favourable, a third generation was reared. Females that emerged after 20th September did not oviposit before hibernating. The eggs were deposited in punctures made through the hull into the seed. The larvae feed on the seed. During the fourth instar they leave the pods by holes cut in them, drop to the ground, and enter the soil, where they later pupate.

The lengths of the various stages are shown in a table. The total periods spent in the seed and in the soil and the egg and pupal stages averaged 7·35, 13·35, 2·76 and 6·6 days, respectively, and the total number of eggs laid by females of the overwintered and first generations in 1937 averaged 54·7 and 24·2.

WOLFENBARGER (D. O.) & BUCHANAN (W. D.). **Notes on Elm Twig Crotch Injuries produced by** *Scolytus multistriatus* **Marsham.**—*J. econ. Ent.* **32** no. 3 pp. 377–381, 9 figs., 3 refs. Menasha, Wis., 1939.

The injuries due to the boring of *Scolytus multistriatus*, Marsh., in the crotches of elm twigs in the eastern United States [*cf. R.A.E.*, A **26** 551] are described and illustrated. Laboratory experiments showed that they were due to adult feeding. In the field, most injuries were found in crotches in the upper and outer parts of the trees, those attacked being *Ulmus americana*, *U. procera* and *U. fulva*. Some borings under thin scales of bark on small branches may have resulted from attempts to make galleries for oviposition. The numbers of injuries made each year from 1928 to 1936 in trees from north-eastern New Jersey and West Virginia are shown on a graph. The decrease since 1933 in the number of injuries in New Jersey may be partly due to the eradication of large numbers of elms affected by Dutch elm disease [caused by *Ophiostoma ulmi*], and possibly to a reduction in the beetle population owing to climatic factors.

Potts (S. F.). **Spraying Woodlands with an Autogiro for Control of the Gypsy Moth.**—*J. econ. Ent.* **32** no. 3 pp. 381–387, 5 figs. Menasha, Wis., 1939.

Difficulties encountered in applying insecticides from an aeroplane to forest areas in the United States are briefly discussed, and accounts are given of preliminary investigations on the use of an autogiro for this purpose. Experiments in 1936 in Massachusetts showed that an autogiro was preferable to an aeroplane for spraying small broken woodland areas for the control of *Lymantria* (*Porthetria*) *dispar*, L., on oak because it could fly more slowly and turn, take off and land in less space, but the aeroplane, with its greater speed and capacity and possible equipment for landing on water, is more suitable for large flat areas. Two types of spraying apparatus are described. Aerial spraying is preferable to aerial dusting because there is less drift, a heavier deposit and better adherence of the insecticide, and a greater number of available working hours. Spraying is effective with a wind velocity of up to 12 miles per hour, whereas dusting is unsatisfactory at a wind velocity of 5 miles per hour. Concentrated mixtures of lead or calcium arsenate with water and fish oil sprayed from an autogiro at the rate of 5–10 U.S. gals. per acre gave satisfactory control of *L. dispar*. The arsenates were used at the rate of 3 lb. per 1 U.S. gal.

Patch (L. H.). **Relation of Number of European Corn Borers per infested Corn Plant to Percentage of Plants infested.**—*J. econ. Ent.* **32** no. 3 pp. 387–393, 1 fig., 2 refs. Menasha, Wis., 1939.

In view of the desirability of obtaining reliable estimates of the abundance of *Pyrausta nubilalis*, Hb., in stalks of maize, data obtained from autumn surveys in Ohio, Michigan and New York from 1926 to 1936 were analysed to determine the degree of variation in the relation between the number of borers per infested stalk and the percentage of stalks infested. The variation was so wide from year to year and from locality to locality that it is concluded that a reliable estimate could not be obtained without actual dissection of the stalks.

Sharp (S. S.). **Agar-Agar, a new Activator for Nicotine Sprays.**—*J. econ. Ent.* **32** no. 3 pp. 394–395, 4 refs. Menasha, Wis., 1939.

Laboratory tests on supplements to sprays of nicotine or nicotine sulphate against *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.) showed that agar-agar activated the nicotine to the same extent as did karaya gum. Only one-third of the normal amount of nicotine was required when it and the spreader were added to a colloidal solution of the activator prepared by boiling 1 part by weight of agar-agar in 500 parts water until it was dispersed. Methods of dispersing karaya gum in water are reviewed from the literature [*cf. R.A.E.*, A **25** 688, 696]. Both it and agar-agar are difficult to disperse and are costly.

Hodson (A. C.). *Sarcophaga aldrichi* **Parker as a Parasite of** *Malacosoma disstria* **Hbn.**—*J. econ. Ent.* **32** no. 3 pp. 396–401, 4 figs., 5 refs. Menasha, Wis., 1939.

In recent years, *Sarcophaga aldrichi*, Parker, has been observed in large numbers in all areas of northern Minnesota where *Malacosoma disstria*, Hb., is abundant. Intensive life-history studies in the summer of 1937 showed that it deposits larvae on cocoons containing larvae, pupae or even occasionally adults of *M. disstria.* About 66 per cent. of the hosts are killed in the pupal stage. Usually one, but occasionally two and in a few cases three larvae developed in one host. Maggots expressed from adults caught in the field and placed on completed cocoons required 2–8 hours to penetrate the fibres of the cocoons and find the host. They can enter almost any part of it. They usually feed for 3–5 days and in favourable weather leave the cocoons 8–12 days after being deposited. During the very dry weather of 1936, most of the maggots remained in the cocoons for more than a month. There is only one generation a year, though *S. aldrichi* also develops on carrion or other organic matter, in which case there may be two generations. In 1937, adults appeared in the field during the last week of May, the males a few days earlier than the females. Pairing began soon after the first females appeared. Of females examined on 20th June, 10 per cent. contained larvae, 40 per cent. large eggs and 50 per cent. undeveloped eggs, but in a batch collected 4 days later, the corresponding percentages were 40, 45 and 15. The maggots were ready to be deposited just as the host was pupating. In 1938, adults of *S. aldrichi* appeared and larvae of *M. disstria* began to pupate about 2 weeks later. The maggots enter the soil in July or early August, form a puparium, pupate, and diapause until the following spring. The diapause can be broken only by exposure to a moderately low temperature for at least two months. Normal larvae and pupae in their cocoons are attacked, and not only parasitised and diseased ones, as is commonly believed. Larvae and pupae of Ichneumonids and larvae of Tachinids are killed when they occur in the same host as *S. aldrichi.* In 1936, 1937 and 1938, *S. aldrichi* was present in 30–80, 60–100 and 90–100 per cent., respectively, of cocoons examined, and in 1938, as many as 2,146 adults of the Sarcophagid were captured in 2 hours in a trap baited with beef.

Willis (H. R.). **Painting for Determination of Grasshopper Flights.**—*J. econ. Ent.* **32** no. 3 pp. 401–403. Menasha, Wis., 1939.

The desirability of obtaining information on the direction, distance and time of grasshopper migration with a view to forecasting infestations is pointed out, and an account is given of preliminary observations made on *Dissosteira longipennis*, Thos., in Colorado in 1937 and on *Melanoplus mexicanus*, Sauss., in Montana in 1938 in which the grasshoppers were sprayed with a lacquer paint consisting of basic pigments, linseed oil and amyl acetate, to which further amyl acetate was added in the proportion of 4 parts to 1 of the mixture. Dispersal was mostly in the direction of the prevailing wind, and the distances covered by *D. longipennis* appeared to be governed by its velocity. However, as marking was done after some movement had already occurred, accurate conclusions on the whole migration could not be drawn. It is concluded that further work should be done, beginning before the first adults leave the hatching ground and using large numbers of grasshoppers.

BALCH (R. E.). **The Outbreak of the European Spruce Sawfly in Canada and some important Features of its Bionomics.**—*J. econ. Ent.* **32** no. 3 pp. 412–418, 5 refs. Menasha, Wis., 1939.

Notes are given on the bionomics of *Diprion polytomum*, Htg., with particular reference to the probable future of the outbreak on spruce (*Picea* spp.) in Canada and the north-eastern United States. The percentage of overwintering larvae that develop into adults in a given season varies considerably from year to year [*cf. R.A.E.*, A **23** 236; **25** 558; **27** 369] and increases from north to south, having averaged about 20 per cent. in the Gaspé peninsula, 70 per cent. in central New Brunswick and considerably more in the New England States [*cf.* **26** 534]. In experiments, temperature had a significant influence on the tendency to go into diapause, and both temperature and humidity were of prime importance in breaking diapause. There is, however, a tendency towards diapause that appears to be genetic, varying in different strains. Lines reared from females taken in the Gaspé all showed a particularly high tendency towards diapause. Exposure to temperatures below the threshold of development is generally necessary to break diapause; about three months of this " cold rest " appears to be needed to bring about maximum emergence, but many larvae require to experience two or more such periods. Adults have been obtained from cocoons that have remained for 6 years in the forest. The degree of humidity influences the percentage emergence from diapause, but maximum emergence is obtained only after contact with free water.

The adults are strong flyers [**24** 315]. Their direction is determined by air currents. They appear to have an instinct for flight that is, temporarily at least, independent of the proximity of spruce. Most females taken from water into which they had fallen had laid some eggs before flight, but were still capable of laying the greater part of the normal number. Heavy infestation is usually preceded by fairly general distribution and noticeable defoliation in small scattered areas, which later coalesce. Some preference is shown for white spruce (*P. glauca*) for oviposition as well as for feeding. In addition to red, black, Norway and blue spruce (*P. rubra*, *P. mariana*, *P. abies* (*excelsa*) and *P. pungens*), Sitka spruce (*P. sitchensis*) is also attacked. The origin of the Canadian form is discussed; it is thought probable that it is one of two European forms [**26** 215], and that it was introduced into Canada during the nineteenth century. The present distribution in North America is given. In 1937, 9,800 sq. miles south of the St. Lawrence river, practically all in New Brunswick and Quebec, had heavy infestations. Medium infestations occurred over an approximately equal area in almost the same regions. Damage, which consists of mortality and loss of growth and vigour, is confined to the heavily infested areas. Mortality is so far almost confined to the Gaspé peninsula.

In a discussion of the probable future development of the outbreak, it is pointed out that *D. polytomum* is well adapted to the climatic and other conditions in the Canadian spruce forests, that apparently no effective natural enemies are present there, that its potential rate of increase is double that of a strictly bisexual species, and that its habit of remaining in diapause protects it from catastrophic reduction in numbers. Areas of heavy infestation are expected to continue to increase and new ones to appear. However, as the reluctance of the larvae to feed on new foliage generally prevents the trees from being rapidly killed, it is hoped that the introduction of one or more effective parasites will eventually produce economic control.

BACK (E. A.). **Psocids in Dwellings.**—*J. econ. Ent.* **32** no. 3 pp. 419–423, 3 refs. Menasha, Wis., 1939.

Heavy losses have recently been sustained by property owners in the United States through broken leases, lawsuits and fees to pest control operators owing to the infestation of houses by Psocids. The species usually concerned are *Liposcelis divinatorius*, Müll., and *Trogium pulsatorium*, L. Infestation usually occurs in newly constructed apartment houses that have large amounts of moisture incorporated in the walls and floors in connection with fire-proofing, and are not allowed to dry out thoroughly before being occupied. This produces the warm, damp conditions ideal for the breeding of the Psocids, which are usually present on building materials, and infestations generally develop 4–12 months after the completion of the building, according to the season at which this takes place. Psocids may also be introduced on new upholstered furniture, rugs, books, papers, groceries, etc. The author is of the opinion that Psocids do not injure wallpaper, furnishings or clothing, but subsist mostly upon moulds prevalent on building material, furnishings or wallpaper, though this has not been proved. Notes on the bionomics of *L. divinatorius* are given from the literature [*R.A.E.*, A **18** 417; **20** 564; **22** 305]. Various control measures have been recommended, including dry storage, applications of dry heat (120–140°F.), dusts and contact sprays, and treatment with several common fumigants, but experience indicates that no single application is likely to give satisfactory results unless all concealed spaces in walls and flooring are reached. This view is supported by notes from correspondence on the control of Psocids, received between 1934 and 1938.

KARR (E. H.). **Fluorine Spray Residue Removal with dilute Solutions of Hydrochloric Acid, Boric Acid and Sodium Chloride.**—*J. econ. Ent.* **32** no. 3 pp. 423–430, 2 figs., 17 refs. Menasha, Wis., 1939.

Hydrochloric acid is often used for removing the fluorine residue from apples sprayed with natural cryolite (sodium aluminium fluoride), which is commonly applied for the control of the codling moth [*Cydia pomonella*, L.] in the north-western United States. Boric acid is sometimes added to the washing solution to increase the solubility rate of the residue [*cf. R.A.E.*, A **22** 652], and, in several cases during 1936, borax (sodium tetraborate) was tried as a source of boric acid. By the addition of borax to hydrochloric acid, boric acid and sodium chloride are formed. As a result of the reaction, the hydrochloric acid concentration is considerably reduced, and enough must be added to restore the original concentration. In several instances in which borax was used, difficulty was experienced in removing the residues, particularly if the temperature of the solution was not more than 100°F. and a single process washer was used, and this was attributed to the presence of sodium chloride. In experiments made in Washington in 1936–37 with a single process, overhead flood type washer, which is described, the addition of 2·2 per cent. boric acid to a solution of 1·5 per cent. hydrochloric acid at 100°F. made it only slightly, if at all, more effective than hydrochloric acid alone. A 1·5 per cent. solution of hydrochloric acid containing 2 per cent. boric acid and 1·1 per cent. sodium chloride at the same temperature was considerably less effective. All the treatments were more effective at 110°F., and the solution containing sodium chloride was not less effective than the others.

Boyce (A. M.), Kagy (J. F.), Persing (C. O.) & Hansen (J. W.). **Studies with Dinitro-O-Cyclohexylphenol.**—*J. econ. Ent.* **32** no. 3 pp. 432–450, 3 figs., 15 refs. Menasha, Wis., 1939.

The following is substantially the authors' summary : Investigations on dinitro-ortho-cyclohexylphenol as an insecticide have been carried out in California since 1935. Certain of its physical and chemical properties that may concern its use on *Citrus* and certain other plants were examined, and a satisfactory colorimetric method of analysis was developed. The solubility of the compound in various organic solvents, including petroleum spray oils, and in water was determined. Its solubility in water increases with a rise in pH, and its distribution between the oil and aqueous phases of spray emulsions is related to the pH of the water. In acidified emulsions (pH 3·5–5) over 90 per cent. of the compound remains in the oil phase at equilibrium. In alkaline waters (pH 8–11), less than 5 per cent. of the compound remains in the oil phase. The phase distribution of dinitro-o-cyclohexylphenol greatly affects the toxicity of emulsions containing it to the eggs of *Paratretranychus citri*, McG., and of *Lygaeus kalmii*, Stål, toxicity increasing in proportion as it remains in the oil phase.

Field investigations showed that certain oil emulsions containing dinitro-o-cyclohexylphenol are effective against *Saissetia oleae*, Bern., on *Citrus* and apricot, *Coccus pseudomagnoliarum*, Kuw., *P. citri* and *Dialeurodes citri*, Ril. & How., on *Citrus*, *Gossyparia spuria*, Mod., on elm, and *Aspidiotus juglans-regiae*, Comst., and *Lecanium pruinosum*, Coq., on walnut. Emulsions of solutions of dinitro-o-cyclohexylphenol in certain water-insoluble organic solvents other than petroleum oil were shown to be appreciably toxic to *S. oleae*, and there was found to be a direct relation between the boiling point of the solvent and the degree of injury to *Citrus*. During 1937 and 1938, the effectiveness of aqueous solutions of dinitro-o-cyclohexylphenol for the control of *S. oleae* on *Citrus* was investigated, and the sodium and triethanolamine salts showed promise. Field results indicated that aqueous sprays containing 0·035 per cent. dinitro-o-cyclohexylphenol in solution as the sodium or triethanolamine salt would give satisfactory control. The physical properties and methods of preparation of the salts were studied. Colloidal dispersions of the compound prepared and used in several ways afforded high mortalities of *S. oleae* and of eggs of *P. citri*, and dust mixtures gave effective control of *P. citri* on *Citrus* and *Tetranychus telarius*, L., on walnuts [see next abstract]. The compound was shown to be toxic to *Eulia* (*Argyrotaenia*) *citrana*, Fern., *Scirtothrips citri*, Moult., *Heliothrips haemorrhoidalis*, Bch., and *Aonidiella aurantii*, Mask., but for various reasons, its use against them is not likely to be practical under field conditions. It is thought that although it may cause injury to *Citrus* and other sub-tropical plants under certain conditions, it can be used on them with comparative safety, especially in dusts and possibly in aqueous dispersions. There is no indication that its use is dangerous to public health.

BOYCE (A. M.), PRENDERGAST (D. T.), KAGY (J. F.) & HANSEN (J. W.). **Dinitro-O-Cyclohexylphenol in the Control of Mites on Citrus and Persian Walnuts.**—*J. econ. Ent.* **32** no. 3 pp. 450–467, 6 figs., 6 refs. Menasha, Wis., 1939.

The results are given in detail of investigations in California on the use of dusts of dinitro-ortho-cyclohexylphenol and either walnut-shell flour or redwood-bark flour against *Paratetranychus citri*, McG., on *Citrus* and *Tetranychus telarius*, L., on walnut [*R.A.E.*, A **27** 261]. Dinitro-o-cyclohexylphenol dissipates more rapidly at high than at low temperatures. Sunlight and humidity have little or no effect on weathering. A deposit of 0·4 microgram per sq. cm. of fruit surface of a mixture of 1 per cent. dinitro-o-cyclohexylphenol and walnut-shell flour (the standard dust mixture) is lethal to females of *P. citri*. Data obtained in the field demonstrated that deposits of the standard dust are much greater when the relative humidity is high than when it is low. When the humidity was low and the temperature moderate, the application of 2 lb. dust per tree resulted in a lethal deposit for about 4 days, but 1 lb. dust did not give a lethal deposit.

As the standard dust gave promising results in an extensive field programme in 1937 for the control of *P. citri*, a demand for the material developed, in response to which, a proprietary product approximately identical with it and known as DN dust was made available in April 1938. An improved dusting equipment was devised, the principles of which are described. A dosage of 1 lb. DN dust per tree when only young fruits are present appears adequate under most conditions, but if there are larger fruits, 1½ or 2 lb. per tree is required. If moisture is present at the time of application, this dosage may be reduced by about 25 per cent. When the foliage is less dense, the dosage must be increased. Two well-timed applications at an interval of 10 or 14 days according to temperature give the best control, though one may be satisfactory. DN dust can be used with only slight injury to *Citrus*, if it is not applied when temperatures above 95°F. are forecast. A mixture of 1 per cent. dinitro-o-cyclohexylphenol and redwood-bark flour appears to be as effective as the standard mixture. Both gave very satisfactory control of *T. telarius* on walnut. One application of 3 lb. dust per mature tree appears to be adequate and has not caused injury of economic importance. DN dust gave high mortalities of *T. telarius* and *Bryobia praetiosa*, Koch, on peaches and almonds without injuring the trees. There appears to be no significant danger to the health of operators applying the dust or of consumers of treated fruit.

HAWKINS (J.). **Corrodentia as Pests of Ground Feed.**—*J. econ. Ent.* **32** no. 3 p. 467. Menasha, Wis., 1939.

Samples of ground feed received from various parts of Maine and stored at room temperature in sealed glass jars were found to be infested by large numbers of nymphs and adults of the Psocid, *Liposcelis* (*Troctes*) *divinatorius*, Müll. Runways could be observed against the sides of the jars. It seems evident that infestation must have occurred before the samples were received.

GRISWOLD (C. L.). **Introduced Pine Sawfly.**—*J. econ. Ent.* **32** no. 3 pp. 467–468. Menasha, Wis., 1939.

All stages of *Acantholyda erythrocephala*, L., are described, and the history of the species in North America, where it was first found in 1925 in Pennsylvania [*R.A.E.*, A **14** 641; **15** 286; **27** 279], is briefly reviewed. Larvae were first taken in New Jersey in 1936, and subsequent surveys have shown that this sawfly is widely distributed throughout the northern half of the State and also occurs in two counties in New York and three in Pennsylvania. The larvae have been found feeding on red pine (*Pinus resinosa*), white pine (*P. strobus*), mugho pine (*P. mugo*), Scots pine (*P. sylvestris*), Japanese red pine (*P. densiflora*) and Austrian pine (*P. nigra* var. *austriaca*), the first two species being the most favoured and the last one the least. They have not been observed to attack larch, spruce or *Abies*, although they do so in Europe. There is one generation a year in New Jersey. The adults emerge in the second half of April and early May. The eggs are usually embedded in rows of 3–10 in slits cut on the flattened surface of the pine needles of the previous year's growth. The egg stage lasts about 22 days. The newly-hatched larvae go to the base of the needles, where they spin a loose web, within which they feed gregariously. Larvae in the later instars spin individual silken tubes. The feeding period lasts 18–20 days, between early May and late June. Fully-grown larvae drop to the ground and form earthen cells 2–3 ins. beneath the surface. In these, they spend the summer, autumn and winter as prepupae, pupating in late March or early April.

JANES (M. J.). **Observations on the Potato Psyllid in Southwest Texas.**—*J. econ. Ent.* **32** no. 3 p. 468, 1 ref. Menasha, Wis., 1939.

Since 1936, when *Paratrioza cockerelli*, Šulc, was found widely distributed on tomato in south-western Texas [*R.A.E.*, A **25** 555], it has continued to infest this crop extensively, though injury has been comparatively slight, and has caused severe damage to potatoes. During the spring of 1938, every potato planting examined in one neighbourhood was heavily infested, and Psyllid yellows was abundant. In some fields, all the plants were affected and the crops were a total loss. The Psyllids were also found in small numbers on egg-plant [*Solanum melongena*] and peppers [*Capsicum*]. Dry lime-sulphur spray and sulphur dust gave promising results in preliminary tests on control. Three native plants, *Lycium carolinianum* var. *quadrifidum*, *Physalis mollis*, which is abundant, and *Solanum triquetrum*, were found to be constantly infested during 1938; they enable the Psyllids to survive in considerable numbers from season to season.

BUE (I. G.) & MUNRO (J. A.). **Notes on the Biology and Control of the Greenhouse Stone Cricket.**—*J. econ. Ent.* **32** no. 3 p. 468. Menasha, Wis., 1939.

Tachycines asynamorus, Adel., an Asiatic species and a pest in greenhouses in many European countries, has been recorded in the United States mainly from the New England and north central States. The most westerly record of its occurrence in the United States is from Colorado. It is nocturnal in habit and has been reported as feeding in greenhouses on tomato, cucumber, and many ornamental plants, as well as on insects and crustacea. Considerable injury was caused to flax seedlings in a greenhouse in North Dakota. Individuals kept in cages under greenhouse conditions fed readily on flies and woodlice, and some cannibalism occurred. Eggs were normally deposited about ¼ in. below the surface of the soil and hatched in 8–12 weeks. Females laid 3–18 eggs per night for about 5 weeks. There was overlapping of generations, new broods appearing at all seasons. The best control was effected by a bait of sodium fluosilicate and ground beef (1 : 9 by weight) which gave 80 per cent. mortality in 4 days when tested in cages containing seedling food-plants. There was no mortality in control cages supplied with beef only. Arsenicals appeared to have a repellent effect.

SCOTT (L. B.) & MILAM (J.). **Cryolite Dips as a Control Measure for the Corn Root Webworm on newly set Tobacco Plants.**—*J. econ. Ent.* **32** no. 3 p. 469. Menasha, Wis., 1939.

In preliminary field experiments carried out in the spring of 1938, it was found that the severe losses caused to newly planted tobacco in north central Tennessee by *Crambus caliginosellus*, Clem., could be reduced by dipping the plants just before transplanting in mixtures of 3 oz. cryolite (containing 85 per cent. sodium fluoaluminate) and 1 U.S. gal. water alone or in combination with fish oil, animal glue, bill-posters' paste or mineral oil. In one experiment, the entire plant was dipped and in the second, only the root and stem. There was no significant difference attributable to the supplementary materials, or to complete as opposed to partial dipping. About 80 per cent. of the treated plants survived for 14 days as compared with about 32 per cent. of the untreated ones.

BLANTON (F. S.) & HAASIS (F. A.). **Transmission of the Narcissus Mosaic Virus by Aphids.**—*J. econ. Ent.* **32** no. 3 p. 469, 1 ref. Menasha, Wis., 1939.

In transmission studies carried out in New York over a period of 4 years, *Aphis rumicis*, L., *Macrosiphum* (*Illinoia*) *solanifolii*, Ashm., *M. rosae*, L., and *M. solani*, Kalt. (*Myzus convolvuli*, Kalt.) gave 66, 36, 65 and 65 per cent. transmission of mosaic, respectively, to healthy narcissus plants when transferred from foliage of narcissus plants showing mosaic symptoms or from cages containing both healthy and diseased plants.

STEINER (L. F.). **Distances travelled by newly hatched Codling Moth Larvae.**—*J. econ. Ent.* **32** no. 3 p. 470. Menasha, Wis., 1939.

Preliminary experiments to gain information on the distances travelled by newly-hatched larvae of the codling moth [*Cydia pomonella*, L.] were carried out in south-western Indiana in late August 1938, in an orchard in which practically no moths were ovipositing. A gauze sleeve containing 200 adults was placed on a low branch on each of four apple trees, one of which had been sprayed with lead arsenate and weak Bordeaux mixture, a second with thiodiphenylamine (phenothiazine) and a third with tank-mixed nicotine sulphate, bentonite and soybean oil, while the fourth had been left unsprayed. The numbers of eggs laid in the sleeves on these trees were 913, 667, 600 and 1,825, respectively. On the unsprayed tree, all apples within 5 ft. of the point of hatching became infested, and there were many fresh injuries between 5 and 10 ft. away, but none on the opposite side of the tree. On the trees sprayed with lead arsenate, thiodiphenylamine and nicotine, no injuries were found more than 5, 6 and 2 ft., respectively, from the point of hatching.

KAGY (J. F.), PERSING (C. O.) & MAXWELL (K. E.). **Fixation Method for distinguising Dead and Live Black Scale on** *Citrus.—J. econ. Ent.* **32** no. 3 p. 470. Menasha, Wis., 1939.

An investigation to develop a satisfactory method of evaluating materials for the control of *Saissetia oleae*, Bern., showed the necessity for an improved method of distinguishing between dead and live scales. Fixation of immature scales on orange leaves in acetic acid vapour before making the counts proved very effective, and this method has been used successfully for two seasons. As a result of fixation, live immature scales are changed from brown to a light yellow or amber colour, while the appearance of dead scales is unaffected. The technique is described.

ZIEGLER (L. W.). **The physiological Effects of Mineral Oils on Citrus.**—*Florida Ent.* **22** no. 2 pp. 21–30, 17 refs. Gainesville, Fla., 1939.

The primary and secondary physiological effects on *Citrus* of spraying with oil emulsions are discussed from the literature, and the results of two experiments carried out on Valencia orange trees in Florida with oil of 70 seconds viscosity and 83 per cent. unsulphonated residue, at a concentration of 1⅔ per cent. actual oil, are described.

A tank-mix spray, applied 25th February 1938, when the average length of new growth was 5 ins., and bloom was heavy, with some fruit set and some unopened buds, produced general shadowing of old and new foliage and slight marginal scorching of the latter. Some of the mature leaves fell. The maximum and minimum temperatures during the week after spraying were 76–84°F. and 33–64°F. The percentages of young fruits discoloured or shed after 10 days, and the average numbers per tree of mature fruits of the 1937 crop fallen on 22nd April and of fruits from spring bloom on the trees (from ground level to a height of 6 ft.) on 22nd April and 3rd September were 39, 52·6, 47·6 and 55·1, respectively, for treated trees and 18·3, 5·4, 65·3 and 88·1 for untreated ones. Owing to the loss of large numbers of leaves, June growth appeared earlier on treated trees, and the next crop was reduced. Since the reduction of crop was proportional to the reduction in leaf area, the growth of immature fruit was not retarded. The average percentages of spring growth terminals showing burst buds on 1st June, and the average numbers of fruit from June bloom per tree (ground to 6 ft. level) on 3rd September were 21·75 and 18·9 on treated trees, and 7·2 and 26·8 on untreated ones.

The same oil, with the addition of 23, 46 and 92 cc. emulsifier per U.S. gallon, was applied to trees with varying crops on 12th May, when the average diameter of the fruits was 3·7 cm. The maximum and minimum temperatures during the following week were 87–94°F.

and 57–72°F. Mature leaves began falling from sprayed trees after 24 hours, and continued to fall for about a fortnight, their numbers being proportional to the size of the trees and not to the amount of emulsifier. The average numbers falling were 543 and 104·5 from treated and untreated trees, respectively. The amount of fallen spring fruits, which began dropping after a few days, and continued to fall for a month, and of fallen spring leaves, decreased with an increase of emulsifier. The average percentages of fallen fruits were 0 and 13·3 from two untreated trees and 44·3, 24·1 and 17·2 from trees receiving sprays containing 23, 46 and 92 cc. emulsifier, and the corresponding percentages of fallen spring leaves were 4·43 and 2·01, and 7·23, 4·46 and 3·99. Shadowing was slightly more continuous when less emulsion was used ; it occurred on 99 per cent. of the spring leaves and on all the spring fruits. On 30th September, a few fruits still showed slight shadowing. No leaves and practically no fruits were scorched. The diameter of the fruits was inversely proportional to the crop on the tree, and averaged 6·1 cm. on treated and 6·69 cm. on untreated trees. The percentages of spring-growth terminals showing burst buds on 1st June were 70 and 25, and the numbers of fruits per tree from June bloom on 27th August were 3·3 and 33, on treated and untreated trees, respectively. No damage resulted from the use of emulsions similar to these at concentrations of 1–1·3 per cent. actual oil during the summer of 1938.

The author concludes that since the insecticidal and phytocidal properties of mineral oils are closely correlated, the application of emulsions of these oils must be timed to give maximum deposit without detrimental plant reaction and minimum deposit for thorough pest control. Emulsifying an oil in such a manner as to reduce the oil deposit upon application to the plant is not effective.

WATSON (J. R.) & BRATLEY (H. E.). **Some ecological Notes on the Lubberly Locust,** *Romalea micropter* **Beauv.**—*Florida Ent.* **22** no. 2 p. 31. Gainesville, Fla, 1939.

The Acridid, *Romalea microptera*, P. de B., though generally distributed in Florida and other parts of the south-eastern United States, has for several years been particularly troublesome in the neighbourhood of farms where narcissus was grown. Its relationship with the bulb farms was therefore studied in Florida in 1938–39. Large numbers of adults were caged in June 1938, and were fed liberally and allowed to lay eggs in the soil. The last eggs were laid in early August, and the first young hoppers appeared on 14th March 1939. The first hoppers were seen on a bulb farm during the same week. The nymphs remain in colonies near the egg masses for several days after hatching. Newly hatched nymphs were found on ditch banks and roadsides, and in a field that was planted with early maize in 1938, but not cultivated after June, and were particularly numerous in a cleaned field with loose, sandy well-drained soil, that had never been ploughed, but were not seen in the more compact soils of undisturbed pine-woods, in bulb fields or in fields that had been cultivated since the previous June. A remarkable migration from the places of hatching to the narcissus fields was then observed. The hoppers moved in columns straight towards the narcissus, sometimes from fields 500–600 feet away. On 24th March, 15 columns were seen in 350 yards, moving against the wind across an asphalt road.

MUNRO (J. A.). **Tillage Operations as affecting Grasshoppers.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **2** no. 1 pp. 3–5, 3 figs. Fargo, N. Dak., 1939.

Experiments were carried out in North Dakota in the spring of 1939 to determine the effectiveness of different methods of spring tillage for grasshopper control. Ploughing, harrowing and disking were carried out in April and May, prior to the commencement of hatching, on selected fields with a fairly high and uniform distribution of grasshopper eggs, those of *Melanoplus mexicanus*, Sauss., predominating. The tillage was done in strips about 25 yards wide, running the full length of the fields, with similar strips left undisturbed for comparison. After hatching, estimates were made of the hopper population on the various plots.

Mould-board ploughing 4½ and 6 ins. deep repeated 3 times was the most effective method, for the eggs were buried in the soil and subjected to temperatures that were 2–8°F. lower than those in the upper soil level, which delayed hatching and also prevented most of the hoppers from reaching the surface. Cross-harrowing (duckfooting) of ploughed plots after the commencement of hatching raised many of the egg-pods to the surface, enabling the hoppers to hatch successfully, and resulted in an average population of 1·5 hoppers per sq. ft. In general, a large hatch followed harrowing, but hopper development depended on the amount of subsequent growth of vegetation.

One-way disking to a depth of 4½ ins., repeated twice, did not bury the eggs as effectively as mould-board ploughing, but proved satisfactory for destroying the vegetation cover. Double disking by use of a tandem disk was shallow and permitted the survival of many plants, which provided food for hatching hoppers. This method is decidedly unsatisfactory for grasshopper control.

METCALF (C. L.) & FLINT (W. P.). **Destructive and Useful Insects. Their Habits and Control.**—2nd edn (revd), Med. 8vo, xvi +981 pp., 584 figs. London, McGraw-Hill Pub. Co., Ltd., 1939. Price £2 10*s*.

This new edition of a valuable text-book already noticed [*R.A.E.*, A **17** 29] has been revised and enlarged to include the results of recent research and data on Arthropods that have recently become pests in the United States. A considerable rearrangement of the material within the chapters in the latter half of the book has been made in order that a more logical plan may be followed throughout. Series of numbers allotted to the insects or groups of insects facilitate cross-reference when information on them occurs in various parts of the book.

WORTH (C. B.). **Observations on Parasitism and Superparasitism (Lepid. : Sphingidae ; Hymen. ; Braconidae, Chalcididae).**—*Ent. News* **50** no. 5 pp. 137–141. Philadelphia, Pa, 1939.

In September 1938 in Pennsylvania, the author observed numerous larvae of *Ceratomia catalpae*, Boisd., on a catalpa tree (*Catalpa bignonioides*) to be heavily parasitised by *Apanteles congregatus*, Say. Of 23 larvae collected, 19 were parasitised, and the number of cocoons on them indicated that the female of the Braconid usually lays about 60 eggs in one host. The cocoons yielded about equal numbers of adults of *Apanteles* and females of a Chalcidoid hyperparasite. From the numbers obtained, the author makes estimates of how the populations of host and parasite would increase in the course of the following year in the absence of mortality from causes other than parasitism, and what rates of mortality would be required to maintain the populations at a constant level.

INGRAM (J. W.), JAYNES (H. A.) & LOBDELL (R. N.). **Sugarcane Pests in Florida.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 89–98. Baton Rouge, La, 1939.

An account is given of observations on insects injurious to sugar-cane in southern Florida, where more cane is grown than elsewhere in the State, and all is used for sugar production.

Diatraea saccharalis, F., is generally distributed throughout the area. In 1934, the percentage parasitism by *Trichogramma minutum*, Riley, of 59 egg clusters collected from one locality was 67 and of the eggs in 2 clusters from another 33. In 1932 and 1933, 500,000 and 1,000,000 individuals of a Louisiana strain of this parasite were liberated, but there was no increase in the yield of sugar from the fields receiving them. Several larval parasites have been introduced against *Diatraea* since 1926 [*R.A.E.*, A **18** 247 ; **26** 390], including *Chelonus annulipes*, Wesm., which was introduced into the United States against the European corn borer [*Pyrausta nubilalis*, Hb.], from Ohio in 1938 and *Apanteles diatraeae*, Mues., in 1934, but only *Microdus* (*Bassus*) *stigmaterus*, Cress., and *Theresia claripalpis*, Wulp, have overwintered in the field. Since 1937, each has been recovered from three new localities into which it was apparently introduced with canes from previously colonised fields [*cf.* next abstract]. Experience, confirmed by an experiment, has shown the value of flooding stubble fields for the control of *Diatraea*. The value of cutting out dead hearts has not been determined.

Wireworms have caused considerable injury to sugar-cane of recent years by boring in the young plants and the buds and by tunnelling in the cane stubs and seed pieces. Most injury occurs at or near the point where the plant joins the seed piece or stub, and the possibility of recovery from this type of damage is slight. Wireworm injuries, which are most severe during February–May, also provide points of entry for red rot (*Colletotrichum falcatum*). In the Everglades, the commonest species is *Melanotus communis*, Gylh ; *Heteroderes laurenti* Guér., and *Orthostethus infuscatus*, Germ., are also found in sugar-cane fields. Wireworm abundance varies greatly ; in April 1935, the average number of larvae in soil samples taken to a depth of 12–18 ins. was 3·2 per sq. ft. by hills of cane and 5·25 in a commercial field sustaining about 40 per cent. loss, but hardly any were found in sites covered by wild grasses or solanaceous plants. A table shows the results of examinations for larvae made in sugar-cane fields in various districts during August and September. Some degree of control has been obtained by delaying planting in spring, but where injury has been severe the use of a larger amount of seed cane is desirable. In experiments with trap baits, the numbers of larvae caught in 3 days by means of old and new potatoes and sweet potatoes buried by hills of cane were 17, 14 and 19, respectively. Unsatisfactory results were given by flooding and by treating experimental plots with kainit at the rate of 300 lb. per acre. The giant toad, *Bufo marinus*, which was imported from Porto Rico and released at two places in 1936, was observed about 2 miles away from each in 1938, but has not increased in numbers sufficiently to have affected the wireworm population.

Saccharosydne saccharivora, Westw. [*cf.* **26** 326] was observed during 1936 on sugar-cane in two localities for the first time since 1909. A single individual was collected among grass and weeds in a peach orchard in Georgia in 1937, but this Delphacid has not occurred on sugar-cane elsewhere in the continental United States. The eggs are deposited in a slit in the mid-rib on the under surface of the leaves, and the nymphs and adults generally occur on the lower surface of the leaves, and sometimes in the central whorl. Other graminaceous food-plants were *Digitaria sanguinalis*, *Dactyloctenium aegyptium* and *Paspalum urvillei*. In September 1936, when in some fields of Co. 290 in one locality this species was responsible for more injury than any other, heavily infested leaves withered, a sooty mould developed on the honeydew, and red rot appeared in the oviposition slits. The variety Co. 281 was only slightly damaged, and in September 1937 injury was much less. Nymphs and adults were heavily parasitised by a Dryinid of the genus *Gonatopus*, and the Capsid, *Cyrtorhinus pellicia*, Uhl., was observed ovipositing in an egg cluster ; no parasites were reared from 103 egg clusters. Recommended control measures include the introduction from the West Indies of the Stylopid, *Stenocranophilus quadratus*, Pierce, which is the most effective parasite of this species in Porto Rico, and of *Anagrus armatus*, Ashm., and the cultivation of narrow-leaved varieties, which are less frequently attacked.

Tarsonemus bancrofti, Mich., was eradicated from the district in Louisiana and one of the two in Florida in which it occurred in 1936 [**26** 28], but in September 1937 infestation had spread in the other area. The older stages cause light amber blisters, which become reddish brown with age, on the surface of the plant. Canes to be transported from infested areas should be soaked in water at 122°F. for 30 minutes as a combined measure against this mite and other pests, including the Coccid, *Pseudococcus boninsis*, Kuw. ; treatment at 115°F. for the same period is effective against the mite. *P. boninsis* occurs throughout southern Florida. It generally feeds on the plant between the leaf sheath and the stalk. Besides causing some direct loss, its presence renders troublesome the manufacture of syrup and is thought to reduce its quality.

The larvae of *Elasmopalpus lignosellus*, Zell., damage young canes throughout Florida by boring into them at and below ground level, and then boring upwards. Most injured plants produce suckers, but growth is delayed and the sucrose content somewhat lowered. Injury was less in fields in which the trash had not been burned.

Cutworms that attack sugar-cane in Florida comprise *Agrotis ypsilon*, Hfn., *Feltia* (*A.*) *malefida*, Gn., *Elaphria chalcedonia*, Hb., *E. nucicolora*, Gn., *Feltia annexa*, Treitschke, *Laphygma frugiperda*, S. & A., and *Cirphis latiuscula*, H.-S. ; the latter caused serious damage in 1932 and 1936. Parasites reared from these cutworms include *Microdus* (*Bassus*) *texanus*, Cress., *Enicospilus purgatus*, Say, *Eucelatoria comosa*, Wulp, and *Paniscus ocellatus*, Vier.

Larvae of the Melolonthids, *Lachnosterna* (*Phyllophaga*) *latifrons*, Lec., and *L.* (*P.*) *clypeata*, Horn, and of the Dynastid, *Cyclocephala* (*Ochrosidia*) *immaculata*, Ol., sometimes cause serious injury to cane in sandy soil ; they are parasitised by Scoliids of the genus *Tiphia*. Other pests that occasionally cause injury are *Sipha flava*, Forbes, *Tomaspis* sp., *Aphis maidis,* Fitch, and *Carolinaia* (*Hysteronema*) *setariae,* Thos. The last two are vectors of sugar-cane mosaic, but the spread of the disease in Florida has been slight, owing to their scarcity.

JAYNES (H. A.). **Further Attempts to establish** *Lixophaga diatraeae* **(Towns.) and other Sugarcane Borer Parasites in Louisiana and Florida, with Recoveries in 1936 and 1937.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 246–258, 13 refs. Baton Rouge, La, 1939.

Attempts to establish the imported Tachinid, *Lixophaga diatraeae,* Tns., for the control of *Diatraea saccharalis,* F., on sugar-cane in Louisiana and Florida are reviewed from the literature [*R.A.E.*, A **11** 392; **18** 247, etc.], and a detailed account is given of a further effort to establish it in 1936–37. Two consignments of adults were received from Porto Rico in May 1936, six generations were reared in the laboratory by an inoculation technique already noticed [**19** 214], and 1,303 adults, including 664 fertilised females, were released during the year at nine points in Louisiana and two in Florida. Recoveries were made during 1936 and the early months of 1937 at five points in Louisiana and one in Florida, but not later in the season. It is concluded that satisfactory temporary control, similar to that afforded in Antigua [see next abstract], may be expected from the Tachinid in the United States, especially in Florida; and, since it was able to survive for several years in earlier liberations in Louisiana [**11** 392], it is recommended that large numbers should be reared, and mated females liberated not later than mid-summer, to enable high populations to be built up before winter, thereby increasing the possibility of permanent establishment. During breeding work at laboratory temperatures, the duration of development from inoculation to adult emergence was found to be constant for the first three generations (May–July), lasting about 3 weeks at about 86°F., after which it increased gradually for the last three (August–November); it was closely correlated with the temperature. A table shows the minimum, maximum and average development periods with the average temperature for each generation. During October, insufficient larvae were obtained from females dissected 9–10 days after mating, and this period was therefore increased to 12–13 days.

A consignment of adults of the Braconid, *Ipobracon rimac,* Wolc., and the Tachinid, *Theresia claripalpis,* Wulp [*cf.* **26** 390] was received from Peru in May 1936, and the former was liberated in May at two places in Florida. Search was made in January and September 1937, but it was not recovered. Some of the original females oviposited, but the resulting adults did not pair in the laboratory in Louisiana, and all those of the next generation were males. Adults of *T. claripalpis* (22 females and 26 males) were also liberated in Florida in May, and five generations were reared in Louisiana, where 52 females and 45 males were released in September. The Tachinid successfully overwintered in an unheated building. Examination in April and May 1936 of dead hearts in a field in the locality in Florida in which was present the parasite determined as a form of *T. claripalpis* in January [**26** 391] showed that the percentage parasitism was 18–29. Adults emerged from puparia in the laboratory, but the strain died out in the following generation. To determine whether the parasite could be spread by movement of infested cane from this district, several tons of canes in which the percentage parasitism was estimated at 40 were transferred late in 1936 for five points in Florida. Examinations were made in September 1937 at and near these points, but only one empty puparium was found. Puparia of the same form of *T. claripalpis* were found in September 1937 in a further district, in which the percentage of parasitism was 7·3. In July 1937, puparia from a district in Louisiana near which adults from Peru had been liberated in 1932 gave rise to adults apparently identical with those from Florida. Further recoveries were made at the end of 1937 from one locality in Louisiana and two in Florida.

Microdus (*Bassus*) *stigmaterus*, Cress. [*cf.* **26** 391] was observed at three new localities in Florida during 1937 as a result of the movement of infested cane, and is now established in five places in the State. The percentage parasitism by it was as high as 16 in one locality.

Other parasites taken in cane fields in Florida in 1936 were a male of *Microdus* (*Bassus*) *texanus*, Cress., a female of *M.* (*B.*) *nigrotrochantericus*, Vier., and a female of *Ipobracon* sp., while an adult identified as *M.* (*B.*) *sanctus*, Say, emerged from a cocoon taken in September 1936 from a borer tunnel in cane.

Box (H. E.). **Biological Control of** *Diatraea saccharalis* (**Fabricius**) **in St. Lucia, B.W.I.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 223–240, 1 fig. Baton Rouge, La, 1939. **Some Aspects of the Campaign against the Moth Borer** (*Diatraea saccharalis* **Fabr.**) **in Antigua and St. Kitts, 1931–1938.**—*T.c.* pp. 495–513, 2 figs., 12 refs.

In the first of these papers, the author describes work from 1933 to 1938 on the biological control in St. Lucia of *Diatraea saccharalis*, F., and *D. canella*, Hmps., on sugar-cane by means of the introduced parasites, *Lixophaga diatraeae*, Tns., and *Metagonistylum minense*, Tns. [*cf.* *R.A.E.*, A **27** 182], and in the second he gives an account of similar work in 1931–38 on the introduction of *Lixophaga* against *D. saccharalis* in St. Kitts and Antigua [**25** 616, 617] and of *Metagonistylum* in Antigua [*cf.* **27** 183].

In Antigua, a survey at the end of 1936 showed that in the 70 fields in which *Lixophaga* was recovered, the percentage current parasitism of *D. saccharalis* averaged 8·01, while over the whole area it averaged 1·95. Although 44 of the positive fields were in the limestone district, the percentage total parasitism in them averaged only 3·8, while on the tuff soils it averaged 8·0. This favourable situation, however, was not maintained, and the colonies diminished, although later in the year it became apparent that many had survived and several had spread to areas of ratoon cane. During March–December 1937, 7,752 fertile females of *Lixophaga* reared in the laboratory were released in 270 plant fields. In a survey of 281 fields carried out between December 1937 and February 1938, the parasite was recovered from 54 fields, 42 of which were on tuff soil, and the percentage of current parasitism averaged 10 for the positive fields and 1·54 for the whole area ; 221 examples of *Lixophaga* were recovered, of which only 26 occurred in the limestone area, about the same average degree of total parasitism being recorded in fields in the limestone and tuff areas, respectively, as in 1936. The reduction in average percentage joint infestation between 1936 and 1938 (12·15–7·34) was comparable with that between 1933 and 1934 (11·50–4·95). The approximately equal annual decrease in joint infestation in both ecological areas, despite the low degree of parasitism on limestone, indicates that *Lixophaga* is of equal value in both; on limestone the host population is low, and since the prevalence of the fungus, *Cordyceps barberi*, further reduces the number of available hosts, the possibility of any extensive multiplication of the parasite is slight, and unless there is a highly infested field in the vicinity, colonies are likely to die out.

As no permanent establishment of *Lixophaga* can be expected in Antigua, the continued uninterrupted liberation of laboratory reared individuals is recommended as a satisfactory method of maintaining infestation by *D. saccharalis* at a low level, until a parasite more suited to the local conditions can be introduced. During 1937–38, large numbers of fertile females of the imported Tachinid, *Theresia claripalpis*, Wulp [**25** 617], were liberated, but no recoveries have been made.

Evidence gained in St. Kitts in 1935 and 1936 showed that *Lixophaga* was established on every sugar-cane estate [*cf.* **23** 345] and that its numerical abundance and the rate of parasitism vary directly with the host population. With each survey, there was an increase in the number of fields that yielded insufficient borers for a sample, but wherever *Diatraea* was present, *Lixophaga* was also found. In 1938, the percentage of joint infestation averaged only 5·1, so that *Diatraea* can now be regarded as a comparatively minor pest in St. Kitts.

TUCKER (R. W. E.). **Report on the Entomological Section** [Dep. Sci. Agric. Barbados] **for the Year ending 31st March 1938.**—*Agric. J. Barbados* **7** no. 2 pp. 65–71. Barbados, 1938.

The field loss of sugar-cane from *Diatraea saccharalis*, F., in Barbados, and the percentage of internodes infested, were less in 1938 than in 1937 [*R.A.E.*, A **26** 221], averaging 8·33 and 16·94 per cent., respectively, although a drought during the growing season had resulted in shorter, and often fewer, internodes, and in larger numbers of dead canes and shoots. This further reduction in damage is considered to be due to the fact that the numbers of *Trichogramma minutum*, Riley, liberated during the year were increased to almost 184 millions. Even larger numbers would have been released if the drought had not caused excessive mortality of *Sitotroga* [*cerealella*, Ol.], the eggs of which are used for the mass breeding of the parasite. Owing to the drought, the young cane was dry and retarded in growth. Such conditions are known to be more detrimental to *Trichogramma* than to *Diatraea*. Increased facilities are now available for breeding *Trichogramma*, but the importation of an effective parasite of the larva of *D. saccharalis* is still considered desirable. The introduced Tachinid, *Lixophaga diatraeae*, Tns. [**25** 42] appears of little use in Barbados, as it was only recovered in negligible numbers at one spot during a wide survey in 1937. There seemed to be some diminution in the damage caused to sugar-cane by *Diaprepes abbreviatus*, L., and *Lachnosterna smithi*, Arr. Larvae and adults of *Pyrophorus luminosus*, Ill., the predacious Elaterid introduced from Porto Rico against *L. smithi* [*cf.* **23** 713], were recovered in 1937 and in May 1938, but there is no evidence that it is increasing.

Although the cotton fields were cleaned after the 1937 harvest, bolls, blown lint and seeds containing live larvae of *Platyedra gossypiella*, Saund., were collected four months later. Cotton residues were found to be of more importance than okra [*Hibiscus esculentus*] in carrying the infestation over from one season to the next. A controlled season for okra, coinciding with the close season for cotton, was instituted at the beginning of 1937. During this period, planting is subject to permit, and all inedible okras must be removed at each picking. The hand-picking of all cotton residues from the fields is considered to be more effective and easier than sweeping the soil. Cotton in some fields was severely damaged by *Alabama argillacea*, Hb., because the dust of Paris green and lime that had been applied was washed away by light showers of rain. Three applications of a spray of lead arsenate with molasses as an adhesive protected a small experimental field of cotton from combined attack by *A. argillacea* and *Xylomyges eridania*, Cram.

Quarantine regulations involving the inspection of imports containing raw cotton, were put into force during the year to prevent the introduction of *Anthonomus grandis*, Boh., which has now reached Haiti.

BONDAR (G.). **O licuriseiro** *Cocos coronata* **Mart. e sus possibilidades na economia brasileira.** [The Licuri Palm, *Cocos coronata*, and its Possibilities in Brazilian Economy.]—*Bol. Inst. cent. Fom. econ. Bahia* no. 2, 18 pp., 3 pls. Bahia, 1938.

Nearly half the area of the Brazilian state of Bahia is covered with forests of the licuri palm, *Cocos coronata*, which is extensively used for various purposes by the natives and since 1915 has become of considerable economic importance, as a valuable oil is obtained from the seeds in the fruits and wax from the leaves. This palm is infested by the larva of the Hispid, *Mecistomela* (*Alurnus*) *corallina*, Vigors, which lives in the bud and feeds on the developing leaflets, and by the weevil, *Amerrhinus ynca*, Sahlb., which develops in the leaf stalks, without, however, doing much harm, because it prefers the leaf bases left after the leaves have fallen. Nearly all the fallen fruits are attacked by the Bruchid, *Pachymerus nucleorum*, F. [*R.A.E.*, A **10** 95], which bores into the stones and breeds in the stored kernels, depreciating their value. Stored kernels are also attacked by an unidentified mite.

BONDAR (G.). **Importancia economica das palmeiras nativas do genero** *Cocos* **nas zonas seccas do interior bahiano.** [The economic Importance of native Palms of the Genus *Cocos* in the dry Regions in the Interior of Bahia.]—*Bol. Inst. cent. Fom. econ. Bahia* no. 5, 16 pp., 5 pls. Bahia, 1939.

Palms of the genus *Cocos*, the licuri (*C. coronata*) [see preceding abstract] and the ariri or licurioba, which the author here describes as *C. vagans*, are put to many uses by the inhabitants of the dry regions in the interior of Bahia. The seeds of *C. vagans* yield less oil than those of *C. coronata*, but the fruits and leaves are used as food for animals. The seeds of both palms are attacked by the same pests [*loc. cit.*] ; the weevil, *Revena* (*Amercedoides*) *nitida*, Hust., attacks them while they are still soft in fruit on the branches, but does not infest the stored seeds.

BONDAR (G.). **Insetos daninhos e parasitas do cacau na Bahia.** [Insect Pests and Parasites of Cacao in the State of Bahia.]—*Bol. tec. Inst. Cacau Bahia* no. 5, 112 pp., 50 pls. (57 figs.), 2 pp. refs. Bahia, 1939.

This monograph on the pests, almost exclusively insects, attacking cacao in Bahia replaces the author's previous work [*R.A.E.*, A **13** 406], which is out of print, and also includes data obtained since the publication of the latter [*cf.* **21** 429 ; **22** 540 ; **25** 759 ; **27** 566, etc.].

KELSALL (A.). **Thirty Years' Experience with Orchard Sprays in Nova Scotia.**—*Sci. Agric.* **19** no. 7 pp. 405–410. Ottawa, 1939.

A brief review is given of some of the developments in spraying materials that have occurred within the last 30 years and that have led to the programme at present applied to apple in Nova Scotia. A programme of 6 sprays is generally employed, of which the first two and the last consist of excess-lime Bordeaux mixture with calcium arsenate, and the intermediate ones of either iron [ferrous] sulphate, lime-sulphur and calcium arsenate [*cf. R.A.E.*, A **19** 473 ; **24** 147] or flotation sulphur and lead arsenate, but wettable sulphurs are sometimes used, chiefly as intermediate sprays, preceded and followed by Bordeaux mixture. Tar distillates are used to a small extent during the dormant season against Aphids and *Phenacoccus aceris*, Sign., and mineral oils are applied during the same period or during the delayed dormant season if required for special purposes, but the use of oil sprays, which appear to interfere with the natural control of *Paratetranychus pilosus*, C. & F., is not encouraged. Nicotine sulphate is applied in the delayed dormant period against *Psylla mali*, Schm., *Spilonota ocellana*, Schiff., *Eulia mariana*, Fern., and Aphids, and pyrethrum, either as a spray or as a dust, is used against *Lygus communis*, Knight, and *Lygidea mendax*, Reut.

BALCH (R. E.). **Further Notes on the Fall Cankerworm and its Control by "Solid-Stream" Spraying.**—*Sci. Agric.* **19** no. 7 pp. 411–423, 4 figs, 10 refs. Ottawa, 1939.

Accounts are given of a recent outbreak of *Alsophila pometaria*, Harr., on elm trees in the city of Fredericton, New Brunswick, and of work on its control in 1938. It was unusually abundant in 1931–38 throughout New Brunswick and Nova Scotia, but severe defoliation occurred only in the lower St. John Valley, New Brunswick, and in three counties in Nova Scotia.

Investigations on the bionomics of this Geometrid showed that females deposit about 148 eggs, generally in one mass, during cool weather in November, and that eggs brought into the laboratory at weekly intervals throughout the winter and kept at 72°F. hatched more quickly and mortality was less after a long exposure to low outside temperatures, although such exposure was not essential for hatching [*cf. R.A.E.*, A **24** 776 ; **25** 374]. The first and last dates on which hatching was observed on the trees during five seasons were 11th and 27th May, respectively, and the hatching period varied from 7 to 14 days, being shorter during warm weather when the eggs of a single mass may hatch almost simultaneously. The percentage of fertile eggs varied from 96·0 to 98·5, except in 1934, after a minimum winter temperature of —31°F., when it was only 89·5.

Most of a batch of newly-hatched larvae brought into the laboratory on 16th May 1937, after exposure to snow and rain at a temperature of 34°F., fed actively, though a few small ones died. The food-plants in order of preference were elm, basswood [*Tilia glabra*], apple, soft maple and oak, but butternut [*Juglans cinerea*], ash, poplar and alder were also attacked. Of batches of 35 third-instar larvae taken from elm, 33, 30, 13 and 6 larvae reached the prepupal stage on elm, oak, red maple and hard maple, respectively. Fourth-instar larvae enter the soil, where they form cocoons, about mid-June; they showed a slight preference for loose soils, although the highest concentration of cocoons per sq. ft. (76) was observed under a lawn. Cinder or gravel surfaces were not penetrated, and it was noted that complete defoliation did not occur in areas in the city in which more than 60 per cent. of the ground below the trees was paved.

Pupation takes place 3–4 weeks after the cocoons are formed, and adults emerge during October–November, the females appearing 2–3 days after the males. Collections of females from 2 banded trees made during 1936–38 indicated that peak emergence occurs about 3rd–5th November; in 1937, from 33 to over 50 per cent. of the total emergence occurred on a warm day following frost. As many as 6,823 females were observed on one tree; it is estimated that an elm of 24 ins. diameter infested by 1,000 females is in danger of complete defoliation. Males and females are approximately equally numerous, and both are active in cold weather; a male was observed in flight at 34°F., and pairing has occurred at 38 and oviposition at 37°F.

The preoviposition period generally lasted 3–4 days, and the average longevity of 19 females was 18 days. The number of eggs laid was dependent on the time of emergence and pairing and also on larval feeding. Undersized females from partly starved larvae contained only about one-third of the normal number of eggs, but a higher percentage was deposited.

During 1937–38, 1–33 per cent. of the eggs in collections were parasitised by *Trichogramma* sp. and an undetermined Chalcidoid, but parasitism, which is highest in this stage, is insufficient for control. The only larval parasite reared was *Macrocentrus amicroploides*, Vier., and parasitism in larvae and pupae did not exceed 5 per cent.

Elms that lose more than half their foliage produce a second, less numerous, crop of leaves about a month later, the annual rings formed during the current and the following year are reduced, and the leaf buds are late in opening in the latter. The vitality of trees with less than 50 per cent. defoliation suffers only slightly. A healthy tree can survive defoliation for two consecutive years, but may be permanently injured by it.

In laboratory tests with sprays of derris, nicotine and pyrethrum in 1938, pyrethrum (0·8 per cent. pyrethrin content) was much the most effective. It gave complete mortality of larvae in all instars in 24 hours when applied at the rate of 3 lb. in 100 gals. water, but when the rate was reduced to 2 lb., the percentage mortality of fourth-instar larvae fell to 40. Similar results were obtained when lead arsenate was added to the spray. The spray finally evolved for use in the city contained 2 lb. pyrethrum powder and 5 lb. lead arsenate in 100 gals. water, and about 26 gals. was applied to an average-sized tree. No adhesive was added, owing to the danger to paint and because lead arsenate had been shown to adhere sufficiently well to elm leaves. The spray was applied to the trees once in 1938, as soon as the eggs had hatched, and almost complete control was obtained. Over 90 per cent. of the larvae were killed by the pyrethrum and almost all the rest by the arsenate.

PETCH (C. E.). **Evaluating Orchard Spray Materials—A Progress Report.**—*Sci. Agric.* **19** no. 7 pp. 424–434, 29 refs. Ottawa, 1939.

After briefly reviewing the literature on the evaluation of crop injury resulting from spraying, the author describes comparative experiments carried out during 1934–37 on apple in Quebec to determine the degree of control of apple scab (*Venturia inaequalis*) and insect pests afforded by various sprays and their effect on the size and quality of the crop, the general growth of the tree and the development of the foliage. The results are shown in tables. The insects concerned were *Cydia* (*Carpocapsa*) *pomonella*, L., the plum curculio [*Conotrachelus nenuphar*, Hbst.], the apple curculio [*Tachypterellus quadrigibbus*, Say], the bud moth [*Spilonota ocellana*, Schiff.], the lesser apple worm [*Enarmonia prunivora*, Walsh] and the green fruitworm [*Graptolitha antennata*, Wlk.]. There was no significant difference in their control by any of 5 spray programmes, in all of which the insecticide was calcium arsenate ; the percentages of the fruits injured by them varied from 2·06 to 2·95.

Injury from all causes was least (14·89 per cent.) in fruits from trees that had received five applications of lime-sulphur and calcium arsenate (1 : $1\frac{1}{4}$: 40), and these trees also produced the largest fruits, but the crops were larger and there were more clean fruits on those that received two applications of lime-sulphur and calcium arsenate followed by two of bentonite sulphur, hydrated lime and calcium arsenate (3 : 3 : $1\frac{1}{4}$: 40), and the general growth of these trees was better. The weight of marketable and clean fruit is considered to be a better criterion for determining the value of insecticides and fungicides than the condition of the fruit at harvest, which has generally been the one adopted. The data presented indicate that an increase in crop production may be correlated with an increase in bud size, twig growth and the ash content of the leaves, and that the differences in these may be due to the fungicides used.

FRAPPA (C.). **Une méthode nouvelle de lutte contre les chrysomèles du riz à Madagascar.**—*Riz et Rizic.* **12** fasc. 1 pp. 33–39, 1 fig., 1 ref. Paris, 1938.

Injury is caused every year to rice in Madagascar by *Hispa gestroi*, Chap., and *Trichispa sericea*, Guér. These Hispids pass the cold season in the pupal stage, either on young rice before it is transplanted or on wild graminaceous plants on the dykes, and the females of the overwintered generation oviposit on the young rice. The larvae mine the leaves and pupate in their mines. The adults also feed on the leaves. There are several generations between the beginning of the hot weather when the rice is transplanted (15th September) and the beginning of the hot-season rains (between 15th November and 15th December). Damage is particularly severe when the rains begin late. In 10 plants examined as early as mid-October, 36 of the 46 leaves (78 per cent.) were infested, each by 1–4 larvae. Late transplanting considerably reduces infestation. In bad seasons, it is estimated that the crop is reduced by 20–25 per cent. As the destruction of wild graminaceous plants, spraying, destruction of the tips of the leaves and immersion of seedlings in boiling water that had been previously recommended [*R.A.E.*, A **25** 602] had not been generally adopted, fresh experiments were undertaken in 1937 to find a rapid, inexpensive and effective method of controlling the adults. Sprays were too costly. Much more practical results were obtained by distributing crude oil, to which 5 per cent. cresyl had been added as a spreader, over the water at the rate of 22 pints per acre, and beating the beetles down on to it by dragging a rope across the rice. By this method, 95 per cent. of the beetles were knocked down, and all of these were killed.

Le Pelley (R. H.) & Melville [A. R.]. **Entomological Work on Coffee.**—*Rep. Dep. Agric. Kenya 1937* **2** pp. 46–54. Nairobi, 1939.

During 1937, large numbers of parasites and predators of *Pseudococcus lilacinus*, Ckll., were received in Kenya from the Philippines, the Netherlands Indies, Ceylon and South India for the control of *P. kenyae*, Le Pelley, on coffee. None of the primary parasites of *P. lilacinus* oviposited in *P. kenyae*. A number of predators including a Cecidomyiid from the Philippines and Coccinellids of the genus *Scymnus* from Java, Ceylon and India were reared through several generations, but bred slowly on account of the difference of temperature between Nairobi and the localities from which they came, and it is not anticipated that they will become established. In addition to morphological differences [*R.A.E.*, A **23** 607], there are important biological differences between *P. lilacinus* and *P. kenyae*. Seven large liberations were made of *Schizobremia coffeae*, Barnes, which was introduced from Bukoba, Tanganyika [**25** 219], and this Cecidomyiid was later found to be breeding at two of the sites of liberation. Only one species from a consignment of parasites of *Pseudococcus* received from the Belgian Congo oviposited in *P. kenyae*, and hardly any of the eggs developed, the greater part being killed by the action of phagocytes.

Damage by *P. kenyae* in Central Province was considerable during late 1936 and early 1937, a period characterised by shortage of rain and more than usual heat, as parasitism of certain predators was high, 80 per cent. of *Hyperaspis senegalensis*, Muls., for example, being parasitised in some cases. With the onset of the long rains, the predators multiplied sufficiently rapidly to effect control. The tendency of outbreaks to recur after banding has been employed against *Pheidole punctulata*, Mayr [**20** 670, etc.] is due to the ability of *Pseudococcus kenyae* to exist for a long time attended by the ants in crevices of the bark below the bands. The treatment of the trunk with lime wash or some other insecticide after an outbreak has been controlled is strongly recommended. Poison baits do not offer much promise for the control of *Pheidole* as, in experiments, the ants fed vigorously for about half-an-hour, but subsequently avoided the bait. An unidentified ant, which has been found to be fairly common on some coffee trees, bores tunnels under the bands, and, if these tunnels reach from bottom to top of the band, they are used by *P. punctulata* to reach the trees. An outbreak of *Pseudococcus citri*, Risso, occurred on coffee in the Machakos district in an area not yet infested by *P. kenyae.*

WILKINSON (H.). **Entomological Section. Annual Report.**—*Rep. Dep. Agric. Kenya 1937* **2** pp. 86–101. Nairobi, 1939.

Busseola fusca, Fuller [*cf. R.A.E.*, A **25** 219] increased considerably on maize in Kenya during 1936 and, in consequence, it was ordered under the Diseases of Plants Prevention (Amendment) Rules, 1936, that all maize roots, stalks, and shelled cores in two districts of the Rift Valley Province should be destroyed by 7th February 1937 and that maize should not be planted before 15th February 1937 or between 31st May 1937 and 15th February 1938, with the result that the population was considerably reduced and little damage was done during the year. *Thrips tabaci*, Lind., was present on pyrethrum plants throughout the areas in which they were grown, and in some cases infestation was heavy. Lime-sulphur sprays (1 : 80) gave complete control. Lists are given of new records of insect pests on cotton, of the plants, all common in Central Province, that have been found to support all stages of *Dysdercus nigrofasciatus*, Stål, *D. cardinalis*, Gerst., *D. fasciatus*, Sign., or *D. orientalis*, Schout., and of the chief stainers of cotton in the different provinces where the crop is grown. *D. orientalis* has not yet been collected from cotton in Kenya. The newly recorded insects include the Lamiid, *Crossotus albopunctatus*, Breuning, which cut stems of all ages, even the main stem, and the Curculionids, *Tetracyphus odontomus*, Chevr., and *Systates saeuberlichi*, Faust, which attacked the bark and the bolls respectively.

Large numbers of *Laphygma exempta*, Wlk., appeared in the Nairobi district towards the middle of March ; after two generations had been produced, the infestation disappeared. It appeared in the Gilgil district at the end of April, and in the Nakuru district at the beginning of May and completely disappeared at the end of June. Some hundreds of square miles were infested, but the damage caused was comparatively slight. Grazing was destroyed in some areas, and in the Nakuru district, about 1,600 acres of young maize had to be replanted. There is a distinct correlation between outbreaks and periods of high temperature and low humidity. The only parasites obtained from the larvae were a species of *Zele* and a Tachinid of the genus *Nemoraea.* After the beginning of the rains, thousands of larvae, destroyed by bacterial and fungous diseases, could be seen hanging from grass stalks.

Accounts are given of the movements of a small swarm of *Nomadacris septemfasciata*, Serv., that appeared to the south-east of Nairobi on 28th July and two larger ones that entered Kenya from Uganda between 18th and 23rd September and returned on 28th and 29th. No damage by the first was reported and slight damage was done by the others. Eggs were laid between 26th and 29th September in cultivated lands and lands recently turned over. Eggs and hoppers were destroyed by mechanical means.

Inspections following complaints that East African coffee was arriving in England infested with *Tribolium castaneum*, Hbst., and *T. confusum*, Duv., showed that infestation is secondary and results from storage near other infested produce in export transit sheds and warehouses or in infested ships. Additions are made to the list of insects injurious to various crops, chiefly coffee. *Dacus curcurbitae*, Coq., which belongs to a group of DACINAE not known to occur in Africa, was found near the port of Mombasa, having presumably been recently introduced. Experiments in which various dusts were compared with locally produced pyrethrum powder for the control of *Antestia*, confirmed the conclusion of previous investigations [**24** 240] that pyrethrum powder at 5 gm. per tree gives a very high percentage kill. Tobacco powder was only slightly toxic, and a mixture of pyrethrum and tobacco (1 : 1) gave very variable results. A series of germination tests with coffee seed of different moisture content treated with carbon bisulphide or heat (120°F.) for the control of *Stephanoderes* [*hampei*, Ferr.] failed to show any differences in germinating capacity attributable to the various treatments. As *Stephanoderes* cannot live in coffee with a moisture content of 12·5 per cent. or less, coffee with a moisture content of 9·6 per cent. was included in the test. It germinated much more quickly than any of the wet coffee, and only 2 per cent. failed to germinate.

Laboratory experiments showed that *Calandra oryzae*, L., in stored maize can be killed by the use of air-tight containers. All the weevils died in bottles with screw caps fitted with cork insets and sealed with paraffin wax. Large numbers of weevils bred in similar bottles not sealed with wax, and the maize felt wet and was green with mould. In unstoppered bottles, in which the moisture content of the maize was found to be 12½ per cent., only the lower layers were attacked, the weevils were much less numerous and no mould developed. A severe infestation of mites was present. It was found that bottles that were stoppered but not sealed were by no means air-tight. The rapidity and percentage of germination of seed that had been kept in air-tight containers were inferior to those of seed kept in open bottles.

A Handbook of Philippine Agriculture.—Fscap 8vo, v+803 pp., illus. [Laguna, P.I.] Coll. Agric. Univ. Philippines, 1939.

This handbook contains information on miscellaneous subjects of interest to farmers in the Philippines. Chapters on pests and diseases of crops include brief notes on measures for the control of common insect pests, on the preparation of insecticides, and on virus diseases transmitted by insects. These comprise bunchy top of Manila hemp [*Musa textilis*], transmitted by *Pentalonia nigronervosa*, Coq., and sugar-cane mosaic and Fiji disease of sugar-cane, transmitted by *Aphis maidis*, Fitch, and *Perkinsiella vastatrix*, Bred., respectively.

CHANG (TSUNG-PING) & LIN (CH'ANG-SHAN). **Life Histories of the important Insect Pests of the Pear Trees in Ting Hsien.**—*Peking nat. Hist. Bull.* **13** pt. 3 pp. 201–226, 18 refs., 6 pls. Peiping, 1939.

Studies were made, chiefly in 1935–36, on six Lepidoptera that attack sand pear (*Pyrus sinensis*) in Hopei and cause an annual crop loss of over 60 per cent., about half of which is due to *Cydia* (*Laspeyresia*) *molesta*, Busck. Accounts are given of their distribution, food-plants and bionomics, and tables summarise the life-histories and indicate approximate dates. All stages of each species are briefly described. Methods of control, including those in use and recommendations made by other workers, are discussed ; the use of insecticides or light-traps is generally impracticable in this district, as the expense involved is too great, and the only measures available are orchard sanitation, hand collection, destruction of infested fruits, buds and twigs, and the protection of the fruits by enclosing them in bags.

The course of infestation by *C. molesta* is complicated by the fact that it produces two generations a year when breeding uninterruptedly on sand pear and four on peach, while each of these trees is liable to infestation by adults migrating from the other. The moths of the overwintered generation emerge at the beginning of May on both food-plants, and some migrate from sand pear to peach ; on sand pear, however, the emergence of some adults may be delayed until as late as the end of June, and these do not migrate. Eggs laid on sand pear hatch in about a week, and the larvae enter the twigs and later the fruits, in which they remain for about 20 days, though some may leave one fruit after about 10 days and enter a second. They pupate towards the end of July, and adults emerge in mid-August. Larvae of the next generation enter the fruits about the end of August and begin to hibernate in the rough bark in mid-September. The moths that migrate from peach to sand pear belong to the three summer generations produced on peach ; they oviposit in late June, and mid- and late August, respectively. The fourth-generation larvae are still in the pears when the latter are gathered, and hibernate in the storage sheds.

Overwintered and summer-generation larvae of the Pyralid, *Numonia* (*Nephopteryx*) *pirivorella*, Mats., destroyed 3·6 and 13·9 per cent. of the pear crop, respectively, in 1935. The life-history in Hopei is similar to that recorded from Korea [**16** 483] ; pupae were observed in infested fruits in June and from late July to early August. The Zygaenid, *Illiberis pruni*, Dyar, which was responsible for a loss of 7·9 per cent. of the crop in 1935, has one generation a year, and also attacks apple, peach and cherry. The larvae, which hibernate under the bark from July or August to the end of February, feed chiefly as leaf-miners before and for a short time after hibernation and as leaf-rollers in April and May, but also attack the buds and young fruits. They pupated in rolled leaves about the end of May, and the adults emerged in mid-June. The females lived for about 10 days and deposited 75–450 eggs, 90–97 per cent. of which were viable, on the leaves. The eggs hatched in 10–16 days. The Geometrid, *Phigalia sinuosaria*, Leech, which is common in North China, Hokkaido and North Honshu, passes the summer, autumn and winter in the pupal stage in the soil. The adults emerged at the end of February, and the wingless females crawled up the trunks of the trees and deposited 75–100 eggs. The larvae hatched in the second half of March and early April, but were inactive in the first instar, though they sometimes attacked the buds. During the second and subsequent instars they fed on the leaves ; feeding continued from the end of March until early May when they entered the ground to pupate. Loose, sandy soil was preferred.

Spilonota ocellana, Schiff., has been recorded in China only from Hopei, where it has one generation a year. The moths oviposited at the end of May or later on the leaves and young shoots. The larvae hatched in about 12 days and bored into leaf or fruit buds, in which they remained inactive until the following spring. In April, they attacked buds and leaves, moving from bud to bud and causing considerable damage. They were full-fed at the end of the month and pupated in the buds, some immediately and others after an interval that sometimes extended until towards the end of June.

The larvae of a Gelechiine Tineid of the genus *Metzneria* bore in the twigs and induce the formation of galls, which cause them to break during high winds in the following year. Adults emerged from the galls in March ; eggs were deposited in crevices in the young stems 3–4 days after emergence, and the larvae hatched and entered the stems at the beginning of April. The fresh galls became apparent in May and reached their maximum size in late July, when the larvae were fully grown. The latter pupated in the second half of September, and the pupae overwintered.

No natural enemies of *C. molesta*, *N. pirivorella*, *P. sinuosaria* or *S. ocellana* were observed, but larvae of *I. pruni* were parasitised by two Chalcidoids and two Sarcophagids. Two Ichneumonids were observed ovipositing in larvae of *Metzneria* and a Chalcidoid was bred from the galls.

NIXON (G. E. J.). **A new British** *Opius* **(Hym., Braconidae).**—*Ent. mon. Mag.* **75** no. 899 pp. 80–82, 2 figs. London, 1939.

Descriptions are given of both sexes of *Opius ilicis*, sp. n., bred from *Phytomyza ilicis*, Curt., on holly in England and also taken in Ireland.

CAMERON (E.). **The Holly Leaf-miner** (*Phytomyza ilicis*, **Curt.**) **and its Parasites.**—*Bull. ent. Res.* **30** pt. 2 pp. 173–208, 15 figs., 30 refs. London, 1939.

The results are given of a study of the Hymenopterous parasites of *Phytomyza ilicis*, Curt., in England, preliminary to the export of such parasites for the control of this leaf-miner in British Columbia, where it has been introduced from Europe and seriously disfigures European holly (*Ilex aquifolium*). The systematic position of *P. ilicis* is discussed. It is concluded that there are only two recognisable species of Diptera that mine the leaves of holly, *P.* (*Chromatomyia*) *ilicis* (*aquifolii*, Goureau), which is of European origin and attacks European holly only, and *P. ilicicola*, Lw., which is confined to North America and attacks both European and American holly (*I. opaca*). The chief morphological differences between the two species are noted, and leaves mined by them are figured. A brief account is given of the life-history of *P. ilicis* in England, where it is substantially the same as in British Columbia [*R.A.E.*, A **20** 66], except that the adults emerge about a fortnight later and the other stages are correspondingly retarded.

In the course of the investigations, five Eulophids, three Pteromalids and one Braconid were reared from material collected in the south of England. All are recorded from *P. ilicis* for the first time. They are, in order of their abundance in 1937 and 1938, *Chrysocharis gemma*, Wlk., by far the most common, *Sphegigaster flavicornis*, Wlk., *C. syma*, Wlk., *Cyrtogaster vulgaris*, Wlk., *Pleurotropis amyntas*, Wlk., *Opius ilicis*, Nixon [see preceding abstract], and finally *Closterocerus trifasciatus*, Westw., *Tetracampe* sp., and *Eutelus* sp., which were extremely rare. All except *Chrysocharis gemma*, which completes its life-cycle in the larva, are parasites of the pupa, and all are exclusively primary except *P. amyntas*, which is also secondary on the larva and pupa of

S. flavicornis, *C. syma* and other primary parasites. Keys are given to the adults of all the species, and to the primary larvae, mature larvae and pupae of all except the three uncommon ones. The distribution and host records of the five most abundant species are given, their general biology is dealt with and the immature stages of each are described. Notes are given on the morphology and classification of Chalcidoid larvae, with particular reference to the groups to which *Chrysocharis* and *Sphegigaster* belong, and the technique employed in the investigations is described.

BARTLETT (K. A.). **The Results of Shipments of the Predatory Elaterid Beetle** *Pyrophorus luminosus* **from Puerto Rico to England.**—*Bull. ent Res.* **30** pt. 2 pp. 209–210, 3 refs. London, 1939.

Consignments of *Pyrophorus luminosus*, Ill., were sent in 1936–37 by steamer from Porto Rico to New York and thence to England for repacking and shipment to Mauritius for liberation against *Lachnosterna* (*Phytalus*) *smithi*, Arr. The larvae were shipped in individual tin salve boxes of the ¼, ½ or 1 oz. size according to the age of the larvae. For the journey to the coast, during which about 2 per cent. of the larvae died, the boxes were filled with soil to prevent excess movement. In the first shipment made to England, sifted soil, unsifted soil, sand, decayed coconut wood, a mixture of sand and soil (1 : 1), and moss, all sterilised with live steam and slightly moistened, were tried as packing media. By far the best results were obtained with the decayed coconut wood. In laboratory experiments in which 6 larvae were packed in each of these media, the total numbers dead after 103 days were 6, 6, 2, 1, 1 and 3, respectively. The mortality in the first two media was attributed to the fact that the soil became hard and ball-like. In later shipments, no moisture was added and excellent results were obtained. A total of 11,281 larvae was sent from Porto Rico to England between 22nd October 1936 and 28th January 1937. Survival was good throughout, though in the first shipments, a few larvae died through exposure to cold. In all, 8,127 larvae were despatched to Mauritius [*cf.* *R.A.E.*, A **26** 316].

HARDY (J. E.). **Natural Control of** *Diprion similis*, **Htg., in Poland during 1936** [1937].—*Bull. ent. Res.* **30** pt. 2 pp. 237–246, 2 figs., 5 refs., London, 1939.

The following is mainly from the author's summary : During a search over Europe for species of the genus *Diprion*, an infestation of *D. similis*, Htg., was located on pine in Poland at Orle, near Wlosclavek. The infestation was remarkable in that 90 per cent. of the prepupae in cocoons spun in the autumn of 1936 did not proceed with normal development in the following year, but remained in a prolonged diapause. An opportunity was thus afforded of studying at length the control exerted by biotic factors on the prepupal stage of the sawfly. By field observations and dissections, it was discovered that predators had killed 46 per cent. of the sawfly population during the winter ; their attacks were not continued during the summer months. Pathogenic organisms proved to be a most efficacious factor of control, for the disease mortality of prepupae surviving the attacks of predators rose from 37·4 per cent. in April 1937 to 86·1 per cent. in the following December. Parasitism of the survivors of both predators and pathogenic organisms rose to its highest peak in October, when 54·9 per cent.

was recorded. At the commencement of warmer weather, the population of Chalcidoid parasites increased rapidly, but suddenly fell to negligible proportions after June, while that of the Ichneumonids continued to rise steadily. It is suggested that the great heat experienced in the early summer months resulted in the death of the Chalcidoids. By consideration of the field data, an attempt is made to separate the effects of the various biotic controlling factors and to assign to them approximate numerical values. The actions of these factors largely overlap each other, with the result that the effect of an individual factor is lessened to a certain degree. Approximate values are calculated for the destructive action of each factor after eliminating interference by other factors, and these conclusions, together with the degree of interference, are set out graphically.

The parasite population was studied by dissections of the host and by the rearing of samples. It comprised the Ichneumonids, *Spilocryptus adustus*, Grav., *Microcryptus basizonus*, Grav., *M. subguttatus*, Grav., *Exenterus marginatorius*, F., *E. laricinus*, Thoms., and *Hypsantyx impressus*, Grav., the Pteromalid, *Eutelus subfumatus*, Ratz., the Torymid, *Monodontomerus dentipes*, Boh., the Eulophids, *Microplectron fuscipenne*, Zett., and *Tetracampe diprioni*, Ferrière, and the Tachinid, *Sturmia inconspicua*, Mg., and also the Ichneumonids, *Leptocryptus pellucidator*, Grav., and *Mesochorus* spp., and the Pteromalid, *Dibrachys cavus*, Wlk., which are hyperparasites. Of the primary parasites, the two species of *Exenterus*, and the Tachinid attack the larva, *T. diprioni* the egg, and the other Chalcidoids, *S. adustus* and the two species of *Microcryptus* the prepupa in the cocoon.

AINSWORTH (G. C.) & OGILVIE (L.). **Lettuce Mosaic.**—*Ann. appl. Biol.* **26** no. 2 pp. 279–297, 2 pls., 18 refs. London, 1939.

An account is given of a mosaic disease of lettuce that sometimes causes great loss in south-western England and is almost certainly identical with that observed in Florida [*R.A.E.*, A **9** 266]. Inoculation experiments with wild Compositae and cultivated plants of other families showed that it can also infect groundsel (*Senecio vulgaris*), *Sonchus asper*, sweet pea (*Lathyrus odoratus*) and garden pea (*Pisum sativum*); and groundsel infected with it was found in the field. Experiments are described in which the virus was transmitted through the seed of lettuce to the extent of about 6 per cent. and in which it was transmitted by Aphids.

In tests in 1934, 3 of 14 lettuce plants to which *Macrosiphum sonchi*, L., had been transferred from diseased plants on 22nd June showed mosaic symptoms on 19th July. All the control plants remained healthy. K. M. Smith obtained about 25 per cent. transmission with *Macrosiphum ribicola*, Kalt. (*Myzus lactucae*, Schr.). In further experiments under controlled conditions, *Myzus persicae*, Sulz., transmitted the virus to 15 out of 33 plants and *Macrosiphum solanifolii*, Ashm. (*gei*, auct.) to 1 out of 23, while *M. solani*, Kalt. (*Myzus pseudosolani*, Theo.), *Myzus hieracii*, Kalt., *Macrosiphum sonchi* and *Rhopalosiphum rufomaculatum*, Wilson, gave negative results. This does not, however, disprove their ability to transmit the virus in the field. Of 10 lettuce seedlings caged in the field on 30th June with diseased cos lettuces infested with Aphids, chiefly *Myzus hieracii*, 7 developed symptoms of mosaic between 18th and 25th July. Of the

Aphids attacking lettuce in south-western England, *Macrosiphum solanifolii* was the commonest. *M. sonchi* and *M. ribicola* were locally abundant. *Myzus persicae* was recorded there from *Sonchus oleraceus*, but not from lettuce, on which it is rare. *Macrosiphum solani*, the saliva of which is toxic to lettuce seedlings, was found infesting lettuce under glass.

Storey (I. F.). **Experiments and Observations on a Virus Disease of Winter Spinach** (*Spinacia oleracea*).—*Ann. appl. Biol.* **26** no. 2 pp. 298–308, 1 pl., 13 refs. London, 1939.

The following is substantially the author's summary: A disease of winter spinach common in the Thames Valley, and characterised by a mottling and malformation of the leaves, stunting of growth and death of the plants, was shown to be caused by a virus identical with cucumber mosaic I of Ainsworth. The disease is most prevalent in the earlier sown crops, and this appears to be correlated with their liability to be infested with Aphids. Field observations on a number of farms indicated a correlation between intensity of infestations by Aphids and intensity of disease. Seed-borne infection, though possible, was not proved. It is suggested that under field conditions in the Thames Valley, a main source of contamination of winter spinach is the outdoor vegetable-marrow crop. Postponement of the date of sowing until the latter half of September is suggested as a method of reducing the amount of disease.

MacGill (E. I.). **A Gamasid Mite** (*Typhlodromus thripsi* **n. sp.**), **a Predator of** *Thrips tabaci* **Lind.**—*Ann. appl. Biol.* **26** no. 2 pp. 309–317, 15 figs., 7 refs. London, 1939.

All stages and both sexes of the Gamasid, *Typhlodromus thripsi*, sp. n., are described from cotton in a greenhouse in north-western England, where it was predacious on *Thrips tabaci*, Lind. An adult may kill 5 or 6 thrips in a day. The first thrips usually appeared on the plants about the first week of May, and the first mites by the end of June. From this time the mites were fairly abundant until the end of November, when the thrips had almost disappeared. The protonymph, deutonymph and adult are very active, but the larva usually remains at the place of hatching until after the moult, which takes place a few hours after hatching at 27°C. [80·6°F.], but may be delayed for 3 days at ordinary temperatures. It is doubtful whether the larvae feed. The period from hatching to pairing lasted, on an average, 14 days at laboratory temperature, with a minimum of 8 days, but at a constant temperature of 27°C., which was the optimum for the development of *Thrips tabaci*, but too hot for the mite, the period was sometimes as short as 3 days. Oviposition began 2–26 days after pairing, the average being 12 days. Only 1 or 2 eggs are laid at a time, at random on the leaf surface, the lower surface being preferred.

Barnes (H. F.). **Some Gall Midge Species and their Host Plant Range.**—*Ann. appl. Biol.* **26** no. 2 pp. 318–347, 1 pl., 53 refs. London, 1939.

The following is based on the author's summary: The need for using biological in addition to morphological characters for separating closely allied species of gall-midges is stressed. An analysis is given of the recorded food-plant range of species of the genus *Asphondylia*, showing that 103 out of 133 are recorded from one species of plant only. The results of four studies concerning gall-midges of economic importance are presented. The first deals with three supposed species that make terminal leaf galls on various species of *Arabis*. It is concluded that this damage is caused by only one true species, *Dasyneura alpestris* (Kieff.) de Meij., *D. schneideri*, Rübs., and *D. arabis*, Barnes [*cf.* *R.A.E.*, A **24** 56, etc.] being synonyms. Certain species of *Arabis* of the subgenus *Euarabis* and one that may belong to the subgenus *Lomaspora* are attacked.

The second study deals with the chrysanthemum gall-midge, *Diarthronomyia* sp. [**25** 389]. Its distribution on commercial chrysanthemums is traced from its initial record as a pest in the United States and Canada in 1915 [**4** 445, 516]; the European countries in which it has been found are the British Isles, Denmark, Finland and Sweden. Experiments on the food-plant range are described. Oviposition, only, took place on nearly all the species of *Chrysanthemum* subjected to trial, galls were formed but no adults developed on one, and the midge was bred successfully on four species and varieties of *Chrysanthemum*, in addition to commercial varieties of autumn chrysanthemums, which were regarded as the control. Eggs were laid also, but no galls were formed, on such plants as *Matricaria inodora*, *Anthemis nobilis*, *A. cotula*, *Achillea millefolium* and *Senecio vulgaris*. It is concluded that the midge of commercial chrysanthemums should be regarded as distinct from *Diarthronomyia hypogaea*, F. Lw., recorded from wild species of *Chrysanthemum* in central Europe.

In the third study, on three species of the genus *Dasyneura*, the larvae of which cause the leaves of *Rubus* spp., *Ribes nigrum* and *R. grossularia* to become twisted and crinkled, *Dasyneura tetensi*, Rübs., would not attack gooseberry and would not pair with *D. plicatrix*, H. Lw. In spite of two records in the literature of *D. tetensi* attacking gooseberry, the conclusion is reached that *D. tetensi*, *D. ribicola*, Kieff., and *D. plicatrix* are all valid species, confined, respectively, to black currant, gooseberry and *Rubus* spp. (including blackberries, dewberry and raspberry). The subject of the fourth study is a hawthorn stem midge observed in western England in August 1937. The life-history of this midge is given, and its bionomics are compared with those of *Thomasiniana oculiperda*, Rübs., and *T. theobaldi*, Barnes, with which it appeared to be closely related. It is concluded that the three are distinct, and both sexes and the larva of the midge from hawthorn are described under the name *T. crataegi*, sp. n.

PETHERBRIDGE (F. R.). **Sugar Beet Pests.**—*Ann. appl. Biol.* **26** no. 2 pp. 397–399. London, 1939.

A black Aphid that oviposits on *Rumex* and conforms to the continental description of *Aphis rumicis*, L., has recently been found in England. It is quite different from the black bean aphis, which has hitherto been referred to as *A. rumicis* but should be called *A. fabae*, Scop. It is suggested that records in the literature to oviposition on *Rumex* refer to *A. rumicis*, a non-migratory species according to continental authorities, and not to the black bean aphis, which may however, migrate to *Rumex* as well as other summer food-plants. Morphological differences between the oviparous forms of *A. rumicis* and *A. fabae* are given. The attack of *A. fabae* on sugar-beet was exceptionally severe in 1938; an average loss of crop of over 1 ton per acre is estimated. Colonies were first found on *Euonymus europaeus* on 9th April and winged forms on 27th April. They were found on broad beans and sugar-beet towards the end of May. Large colonies were formed on sugar-beet during June and early July, but they had practically disappeared at the end of July, on account of the activity of abundant predators, especially Coccinellids. None was observed on the sugar-beet crop after the middle of August, but one sugar-beet plant was found heavily infested on 17th September. No other Aphids were found in the same field. Return migrants were first seen on *E. europaeus* on 16th September. There were very few males in the Cambridge district, and few eggs were laid. In experiments with six treatments for the control of the Aphid on sugar-beet grown for seed, nicotine dust gave the best results and was considered economically justifiable. The yield of one field that was treated according to instructions by topping badly infested plants and then dusting with 3 per cent. nicotine dust was very satisfactory. A 3 per cent. nicotine dust is effective on warm days; 4 per cent. gives better results on colder days. No treatment was economically justified for the ordinary crop.

In 1938, satisfactory stands of beet were obtained in freshly ploughed grassland sown with beet intersown with wheat as a protection against wireworms, which were present at the rate of 2–10 per sq. ft., and previous results [*R.A.E.*, A **26** 462] were thus confirmed.

ROEBUCK (A.). **Pests of the Sugar Beet Crop in the Midlands.**—*Ann. appl. Biol.* **26** no. 2 pp. 399–401. London, 1939.

Since 1922, 24 species or groups of insect and other pests have been recorded on sugar-beet in the English Midlands. The most injurious of the insects have been flea-beetles, which were serious pests in 1930 and 1935, more damage probably being done by *Phyllotreta* spp. in both years than by *Chaetocnema concinna*, Marsh.; *Atomaria linearis*, Steph., which was moderate in 1925 and 1931 and severe in 1929 and 1935; *Aphis fabae*, Scop.; and cutworms (*Agrotis* spp.).

WRIGHT (D. W.). **The Control of Onion Fly** (*Delia* [*Hylemyia*] *antiqua* **Meig.**).—*Agriculture* **46** no. 2 pp. 147–154, 2 pls., 2 refs. London, 1939.

After a brief review of the results of previous work showing the value of calomel [mercurous chloride] against *Hylemyia antiqua*, Mg., on onion [*cf. R.A.E.*, A **26** 298, 536], an account is given of an experiment carried out in 1938 near Cambridge on the most economical method of using it. Calomel applied to the seed before sowing at rates of 12 oz. and 1 lb. per lb. seed, with dilute flour paste as an adhesive [*cf.* **26** 298], increased the yield of the plants (in comparison with untreated ones) by 507·2 and 728·5 per cent., respectively, while a 4 per cent. calomel dust, applied along the rows at the rate of 1 lb. to 50 yards when the plants were about 1¼ ins. high and again 10 days later, increased the yield by 636·2 per cent. The difference in the figures for the two seed treatments is significant, but the differences between the dust treatment and the others are not. Applications to the seed of dilute flour paste alone and of an equal weight of an inert dust (ground limestone) with a proprietary sticker were made for comparison, but had little or no effect on infestation and increased the yields by only 55·6 and 33·9 per cent., respectively. The calomel was apparently still effective 3–4 months after application, since the percentages of bulbs damaged by larvae of the third generation were 21·5 in untreated plots, 7·1 in those planted with calomel-treated seed (1 : 1) and 7·3 in those dusted with calomel. Subsequent laboratory tests showed that a deposit, approximately 1 mm. thick, of 4 per cent. calomel dust could be exposed on the surface of moist soil for 3 months in a heated glasshouse without losing its toxicity to the eggs and larvae of certain Diptera.

These results were confirmed in small-scale field experiments in which infestation was less severe but treating the seed with an equal weight of calomel doubled the crop yield in two cases and increased it in a further four. Pot experiments showed that treating the seeds with an equal weight of calomel before sowing also gave satisfactory control of *H. antiqua* on leeks. Both onion and leek seed treated with calomel immediately before sowing germinated better than untreated seed, and the growth of the plants was in no way impaired. Treated seed retained its viability when stored in containers of wood, cardboard or paper, but when stored in closed glass or metal containers for about two weeks it gave rise to malformed seedlings, and with longer storage its viability decreased rapidly. It was killed in 10–16 weeks. Whether seed treatment is more economical than dusting depends on the density at which the seed is sown, since the quantity of dust used varies little with the density of the plants in the row.

RAUCOURT (M.). **Le contrôle d'efficacité des produits antiparasitaires agricoles.**—*18e Congr. Chim. industr. Nancy 1938* pp. 731–735 multigraphed. Paris [1938].

The technical and administrative difficulties involved in forming an organisation in France to examine and certify the effectiveness of commercial insecticides and fungicides are discussed, and it is considered that a preliminary condition of success is the development of sufficiently accurate methods for biological tests. The examination should be optional, and the certificate granted should state only that a sample of a product of known composition used at a certain dosage and under known conditions gave satisfactory results. The procedure to be adopted when it is suspected that marketed products are not uniform with the sample is described. In order to test this theoretical organisation, a decree of 28th February 1938 delegated the examination of substances for the control of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] to the research services of the Ministry of Agriculture. The organisation was put into force in 1938, with provisional regulations, the text of which is given, and more than 50 products were examined.

STĘPNIEWSKA (K.). **Przyczynek do biologii owocnicy jabłkowej,** *Hoplocampa testudinea* **Klug w Polsce.** [Contribution to the Biology of *H. testudinea* in Poland.]—*Roczn. Ochr. Rośl.* **6** fasc. 1 pp. 43–48, 4 figs. Puławy, 1939.

Hoplocampa testudinea, Klug, has been considered a minor pest of apples in Poland, but occurred in many districts there during recent years, causing 75 per cent. of the fruitlets to drop. A study of its biology, carried out in central Poland in an insectary and in orchards in 1936 and 1937, showed it to be similar to that observed in England [*cf. R.A.E.*,A **20** 579]. It is probable that two generations may sometimes develop in a year if the weather is favourable; in 1936, when the summer was wet, larvae thought to be of a second generation occurred in the orchards, and eggs were laid in the insectary in July, though they did not hatch. There was only one generation in 1937 when the summer was hot and very dry. The adults emerged from pupae in the soil in the first half of May, when the apples were flowering; those in the insectary lived for 4–7 days. Oviposition took place during the period of petal fall, the eggs being laid under the epidermis within the calyx ring between the pistil and stamens. The egg stage lasted 15–18 days. The young larvae mine under the epidermis of the fruitlets, causing scars to appear on the surface, and gradually penetrate deeper. Some die before reaching the core, in which case the apples ripen, though their appearance is impaired by the scars. Fruitlets drop if the core is destroyed. One larva usually eats out the core of two or three apples. By the time the fruitlets reach the size of walnuts, the larvae abandon them to spin cocoons in the soil, in which they pupate in the following spring. In the insectary, the first pupae occurred on 30th March.

KOZIKOWSKI (A.). **Stan kwestii chrabąszczowej w Polsce.** [The Status of the Cockchafer Question in Poland.]—*Roczn. Ochr. Rośl.* **6** fasc 1 pp. 49–56, 8 maps. Puławy, 1939.

In Poland, severe damage to forests and agricultural crops is caused by the larvae of *Melolontha*. *M. melolontha*, L., chiefly occurs in the western part of the country and on the southern slopes of the eastern Carpathians, and *M. hippocastani*, F., in the central and north-eastern districts. A survey is given of investigations that have been carried out by the author and other workers in Poland since 1923 on the biology, local distribution and control of these cockchafers [*cf. R.A.E.*, A **26** 154; **27** 9, etc.]. It is concluded that the use of soil fumigants against the larvae is impracticable owing to the cost, and that collection of the larvae or adults is ineffective. It has been observed that infestation is less severe where crops such as potatoes and cereals have been grown year after year, probably because the females oviposit little in soil shaded by such crops and many of the larvae are destroyed by the annual cultivation.

NUNBERG (M.). **Masowe pojawianie się zawisaka borowca** (*Sphinx pinastri* **L.**) **w Polsce.** [A Mass Appearance of the Pine Sphingid *S. pinastri* in Poland.]—*Roczn. Ochr. Rośl.* **6** fasc. 1 pp. 57–65, 13 refs. Puławy, 1939.

In 1935, pupae of *Sphinx pinastri*, L., were present in unusually large numbers in the ground litter of pine forests covering an area of over 8,000 acres in north-western Poland. In 1936, the larvae were very abundant, and in some places destroyed 75 per cent. of the needles at the end of the summer. In 1937, however, adults, eggs and larvae were scarce, while pupae were numerous; this indicates that the Sphingid requires two years to complete its life-cycle, and that the adults observed had emerged from pupae that had overwintered twice. Females deposited 74–156 eggs, the oviposition period lasting 3–5 days.

The eggs, which are described, were laid singly and hatched in 11–12 days. The larvae fed on old needles.

In 1937, all the eggs collected in one of the forests on 10th August were parasitised by *Trichogramma evanescens*, Westw., which has not previously been reared from this host ; on an average, 37 parasites emerged from each egg. About 80 per cent. of the larvae were attacked by a Tachinid of the genus *Campylochaeta*, and about 15 per cent. of the pupae were parasitised, either by a fungus (*Isaria*) or *Zenillia* (*Phryxe*) *vulgaris*, Fall., *Aphanistes ruficornis*, Grav., *Ichneumon pisorius*, L., or *Dirhinus* (*Pteromalus*) *alboannulatus*, Ratz. *I. pisorius* was the most abundant of the parasites obtained from the pupae and was itself parasitised by *Theronia atalantae*, Poda.

[Prikhodkina (T. D.).] **Приходкина (Т. Д.). Action of Moisture on the Fecundity of the Cutworm Moth.** [*In Russian.*]—*Nauch. Zap. sakh. Prom.* **15** (1938) no. 3–4 pp. 177–183, 7 refs. Kiev, 1939.

Field observations carried out in different parts of the Russian Union on the numbers of eggs deposited by females of *Agrotis segetum*, Schiff., and periodical dissections of females confirmed data from the literature that the moth shows great fluctuations in fecundity, which ranged from 50 to over 2,000 eggs per female. In the beet-growing districts of the Ukraine, such fluctuations cannot be the result of malnutrition during the larval stage [*cf. R.A.E.*, A **25** 139], as the larvae feed on beet, *Atriplex*, autumn-sown wheat, *Sonchus* and *Convolvulus*, none of which decreases the fecundity of the adults. Investigations were therefore made on the relation between weather conditions and fecundity.

Tables show the mean temperatures and rainfalls recorded in 1930 and 1934–37 in different districts in the Ukraine for the periods of pupation of the overwintered and first generations, from about mid-April to the first half of June, and in the second half of July and the beginning of August, respectively, and during the flight of the resulting adults ; and notes are given on the abundance in these years of the moths and of the numbers of eggs found in dissected individuals in 1934–37. Adults of the overwintered generation were most abundant and females contained the greatest number of eggs (500–2,000) in 1935, when the spring was wet and cool ; as a result, beet fields were severely infested by larvae of the first generation. In 1934 and 1936, when the spring was considerably drier and warmer, only 100–300 eggs were observed in the ovaries, and the larvae of the first generation were less abundant. In 1937, the moths were definitely more fertile in districts in which there was more rainfall during the period of pupation. First-generation adults contained the greatest number of eggs in 1934, following abundant rainfall during the period of pupation, and the least (up to 365) in 1936, following very hot and dry weather. In 1935 and 1937, when rainfall was less than in 1934 but more than in 1936, dissected females contained 500–800 eggs in the ovaries. Favourable conditions of humidity during the flight of the adults had no effect on their fertility and did not compensate for high temperature and lack of humidity during the period of pupation [*cf.* **25** 503 ; **27** 455].

From these investigations, the author concludes that in the beet-growing districts of the Ukraine, outbreaks of *A. segetum* may occur in years in which the amount of rainfall reaches 30 mm. [about 1·2 ins.]

in April and May and 50–100 mm. [about 2–4 ins.] in July and the beginning of August. Hot and dry weather during the period of pupation is detrimental to the fertility of the adults.

[Charkovskiĭ (M. P.).] **Чарковский (М. П.). A Contribution to the Methods of shortdated Forecasts of the Beet Weevil Infestation.** [*In Russian.*]—*Nauch. Zap. sakh. Prom.* **15** (1938) no. 3–4 pp. 184–197, 7 figs. Kiev, 1939.

With the object of determining the best time for the preparation and clearing of trap ditches against the beet weevil, *Cleonus punctiventris*, Germ. [*cf. R.A.E.*, A **25** 278, etc.], field observations were carried out in the province of Kiev in 1935 and 1936 on the emergence and migration of the overwintered adults and their relation to weather conditions. For this purpose, the weevils were collected daily between 1st April and 26th May in both years from a section of a ditch dug round a field that had been under beet in the preceding year, and from trap-pits, and their numbers compared with the prevailing humidity and the temperature of the air and soil.

It is concluded from the results, which are given in detail, that the chief factors on which the emergence and migrations of the weevils depend are solar radiation and the resulting temperature on the surface of the soil and in the layers in which the weevils hibernate. The overwintered weevils begin to emerge on sunny days when the average daily temperature of the air reaches 6–7°C. [42·8–44·6°F.] and that at the surface of the soil 7–8°C. [44·6–46·4°F.], the corresponding figures for mass emergence being 10 and 12°C. [50 and 53·6°F.], respectively. The intensity of emergence decreases in dull weather. Migrations take place only during the day, and their intensity varies directly with temperature. Usually, migration reaches a peak at the time of day at which the soil surface is warmest. The common belief that emergence always occurs in one or two waves is erroneous, as there were five distinct periods of migration in 1935, with peaks on 15th and 25th April and 7th–8th, 13th and 18th May, and three in 1936, with peaks on 16th–17th, 26th and 29th–30th April. Emergence is completed when the temperature in all the layers of the soil in which the weevils overwinter exceeds 10°C. The accumulation of considerable numbers of weevils in trap-pits in ditches in June and July is not due to further emergence from the soil but to migration from infested fields of weevils that have completed the period of intense feeding, pairing and oviposition. A prevalence of males in the ditches indicates that maximum emergence has not yet taken place, whereas a prevalence of females shows that the peak has been reached and that the mass migration of the weevils is approaching its end. It is considered that meteorological data of the type given can be used as a basis for a local forecast of the emergence and migrations of the weevil.

[Pospelova (V. M.).] **Поспелова (В. М.). Notes on the Wireworms in the Region of Tomsk.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 16–35, 5 diagr., 20 refs. Leningrad, 1939. (With a Summary in English.)

In the Tomsk region of western Siberia, considerable damage to cultivated crops, especially vegetables, is caused by Elaterid larvae [*cf. R.A.E.*, A **18** 48; **26** 426]. A list is given of 32 species found there since 1901, with notes on their frequency and the dates and localities of records. Examination of soil samples from different districts in 1935 showed that *Agriotes obscurus*, L., constituted 93·7–100 per cent. of all the wireworms present in fallow land or in fields of potatoes, tomatos, crucifers, clover or peas. In the case of tomatos, the larvae sometimes penetrated into the fruits when the latter were touching the soil, up to 11 wireworms occurring in a single tomato. *Corymbites* (*Selatosomus*) *aeneus*, L., and *C.* (*S.*) *latus*, F., were the most abundant species in soil that had not been used for crops and fields of cereals, and *C. aeneus* and *Lacon* (*Brachylacon*) *murinus*, L., also attacked cabbage. Other species were scarce and occurred mostly in forest land. Special investigations showed that loose soils with a high content of humus, heavily manured, or overgrown with *Agropyrum repens* or *Barbarea vulgaris* were the most severely infested by *A. obscurus*, whereas *Corymbites* preferred compact clay soils.

The adults of *A. obscurus* were on the wing from the end of May until the beginning of July, the maximum flight occurring in the second half of June. The prevalence of young larvae in fallow land and clover fields indicated that oviposition chiefly occurred in these habitats. The larvae concentrated in the upper layers of the soil at depths of less than 2 ins. in the second half of May, but they descended deeper as the soil dried. Most of them were at a depth of 2–8 ins. in July and August, and up to 11 per cent. at 12–30 ins. in September, when 4 mature larvae were found as deep as 50 ins. In March, some of the larvae were at a depth of 35–42 ins. No diseases or parasites were observed.

[GILYAROV (M. S.).] **Гиляров (М. С.). Rows of attractive Plants as a Measure for the Protection of Tau-saghyz.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 36–42, 16 refs. Leningrad, 1939. (With a Summary in English.)

Recent investigations in the Russian Union have shown that the use of poisoned baits against soil pests, such as wireworms and Lamellicorn larvae, that attack the roots of rubber-producing plants is usually ineffective, as in damp weather most of the larvae feed on the humus and decaying matter present in the soil, and in dry weather they penetrate to greater depths in search of moisture. The baits, which should always be moist, are of most value in spring when the soil is beginning to dry but wireworms are still in the upper layers, so that they compensate for the lack of the moisture by feeding on the baits.

In 1935, field experiments were carried out in southern Ukraine to ascertain whether it would be possible to protect tau-saghuiz [*Scorzonera tau-saghyz*] from infestation by attracting the pests to sugar-beet, since cage experiments in 1934 had shown that larvae of the Dynastid, *Pentodon idiota*, Hbst., greatly preferred beet to tau-saghuiz when both were available. In the field experiments, sugar-beet was sown in strips on 9th–10th April between the rows of tau-saghuiz and at a distance of 8 ins. from them, after the tau-saghuiz, which had been sown in the preceding November, had sprouted. Examination of the soil in August showed that it contained larvae of at least 13 species of Coleoptera, a list of which is given. Counts made at intervals from 26th June to 25th October showed that the percentage mortality of plants of tau-saghuiz gradually increased from 11·2 to 21·3 in the plots with beet and from 22·2 to 38 in the control. It was not possible to obtain a crop of sugar-beet, since it proved necessary to cut down the foliage twice, as it developed so vigorously that the tau-saghuiz was shaded and its growth retarded. On the other hand, this delay in development apparently safeguarded the tau-saghuiz from infection with root rot, which only attacks large well-developed roots that crack. In the experimental plots, the tau-saghuiz was chiefly injured by larvae of *Amphimallus solstitialis*, L., and *P. idiota* ; it was not attacked by those of *Agrotis segetum*, Schiff., or *Loxostege sticticalis*, L., though both these Lepidoptera infested the beet, and the former also attacked the tau-saghuiz in the control plots.

[BORKHSENIUS (N. S.).] **Борхсениус (Н. С.). Observations on the Fauna of Coccidae in the Caucasus.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 43–51, 7 figs. Leningrad, 1939. (With a Summary in English.)

Records are given of 13 species of Coccids found in the Caucasus, showing their food-plants and distribution and the dates of collection. They include the following new species, the adult females of which are described : *Phenacaspis prunorum* on the leaves and shoots of plum ; *Cryptococcus aceris* on the stems of maple ; *Phenacoccus caucasicus* on the leaves and *Pseudococcus furcatispinus* on the roots of unnamed graminaceous plants ; *Phenacoccus agropyri* and *Pseudococcus kazanskyi* on the roots and leaves, respectively, of *Agropyrum* sp. ; and *Trionymus levis* on the roots of an unidentified mountain plant.

[SAKHAROV (N. L.).] **Сахаров (Н. Л.). On the Causes of White-ear in Cereals.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 52–60. Leningrad, 1939. (With a Summary in English.)

Investigations in different parts of the Russian Union have shown that " white ear " in cereals is due chiefly to climate, the type and condition of the soil and the physiological state of the plants, which, together with unknown factors [*cf. R.A.E.*, A **24** 816, etc.], sometimes cause this condition in 25 per cent. of the plants in a field, whereas diseases and Arthropods, chiefly insects, cause it in only 0·01–14 per cent. The following Arthropods have been found to be responsible for white ear: *Mayetiola destructor*, Say, *Oscinella frit*, L., *Rhopalosiphum prunifoliae*, Fitch (*Siphonaphis padi*, auct.), *Oria musculosa*, Hb., *Aeropus* (*Gomphocerus*) *sibiricus*, L., and larvae of Lamellicorns and *Dorcadion* sp. in wheat ; *Cephus pygmaeus*, L., and *Meromyza saltatrix*, L., in wheat and rye ; wireworms and Tenebrionids in oats ; *Pediculopsis graminum*, Reut., in rye, wheat and oats ; and *Ochsenheimeria taurella*, Schiff., in rye, wheat and brome grass [*Bromus secalinus*]. The type of injury caused is described for each pest.

[ÉÏDEL'MAN (Z. M.) & LESNIKOVSKIĬ (G. M.).] **Эйдельман (З. М.) и Лесниковский (Г. М.). The Effect of the Dates of Winter Spraying with Oil Emulsions on the vegetative Growth of the Apple Tree.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 130–135, 4 refs. Leningrad, 1939.

The effect on the growth and vegetation of apple trees of winter spraying with oil emulsions was studied in 1936 in an orchard in the south of European Russia, where this measure is recommended against *Aspidiotus perniciosus*, Comst. Six-year-old trees were sprayed once, twice or three times with a 4 per cent. emulsion of machine oil prepared with iron sulphate, the dates of application being 9th January, 29th February and 23rd March. In these months the temperature varied from 16·5 to −6·4°C. [61·7–20·48°F.], 20·1 to −22·6°C. [68·18 to −8·68°F.] and 20·1 to −7·1°C. [68·18–19·22°F.], respectively, but there was no frost on the days of spraying.

Observations on the treated trees in March and April showed that the swelling and opening of the fruit buds, and in one variety of apples the appearance of the first leaves, occurred 3 days earlier on them than on untreated trees. The sharp fall in temperature in February had no effect on the general condition and further development of the sprayed trees. To determine the part played by frost and emulsions in injuring trees, special experiments were carried out in Leningrad in which three-year-old apple seedlings were sprayed at the beginning of December 1935 with 4 per cent. emulsions of solar or refined machine oil, while others were smeared with the non-emulsified oils [*cf. R.A.E.*, A **26** 482]. The trees were kept outdoors, where the temperature fell as low as −26 and −28°C. [−14·8 and −18·4°F.] at the end of January, and on 10th February they were transferred to a greenhouse to accelerate their development. No injury to the twigs, buds or trunk was observed in the sprayed seedlings, but in those that were smeared with the oils many of the buds and tips of the previous year's twigs were damaged. The bark of the trunk, however, was not affected, and towards mid-July the seedlings produced abundant foliage from dormant buds. Examination of the smeared branches showed that the particles of solar oil penetrated actively into the tissues of the twigs and buds, and the injury was caused by the toxic effect of the oil on the tissues. The refined machine oil penetrated only slightly into the tissues and chiefly remained on the surface of the twigs and buds.

[SHCHERBINOVSKIĬ (N. S.).] **Щербиновский (Н. С.). Seasonal Migrations and Behaviour of the Clover-seed Beetle.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 136–141, 5 refs. Leningrad, 1939.

The statement by Russian workers that weevils of the genus *Apion* migrate in the autumn from clover fields to forests was confirmed by field experiments carried out in 1937 in the Province of Tula (central Russia), in which 85,000 weevils were stained with a water solution of fuchsin and released in the centre of a clover field in mid-August. Systematic observations showed that by the end of September some of them occurred among fallen leaves at the edge of a forest about 550 yards away. The density of the weevils there was 540 per sq. yard, as compared with only a few in the clover fields [*cf. R.A.E.*, A **26** 474]. In the spring, the clover becomes reinfested first by weevils that have hibernated in the fields, and then by others that migrate from a distance.

In order to determine the best time to apply insecticides or use apparatus for catching the weevils, the behaviour of sexually mature adults of *Apion apricans*, Hbst., at different temperatures and times of the day was observed in the laboratory and in the field in May–June. The results showed that torpor occurs at temperatures below 0°C. [32°F.], activity gradually increases at 8–12°C. [46·4–53·6°F.], and feeding is intense at 18°C. [64·4°F.], at which temperature the weevils also begin to climb up the clover plants to reach the heads. The peak of activity and mass pairing were observed at 20–28°C. [68–82·4°F.]. At 28–38°C. [82·4–100·4°F.] the movements of the weevils became abnormally rapid and feeding ceased ; at 32–33°C. [89·6–91·4°F.] there was a mass migration from the upper to the lower parts of the plants ; and death occurred at 51–53°C. [123·8–127·4°F.]. It is concluded, therefore, that the use of apparatus for catching the weevils would be most effective at temperatures ranging from 20 to 28°C. in dry weather, even if the sun is not shining.

It was found that most of the old adults of *A. apricans*, *A. aestivum*, Germ., and *A. flavipes*, Payk., did not migrate to clover fields, but remained in forests during the entire summer. An analysis of the stomach contents of individuals taken there in June showed that they had fed not only on Leguminosae but also on a variety of plants of other families. At the same time, the ovaries of the females were only in the initial stages of development so that there was no stimulus for migration to clover, to which the weevils are attracted for oviposition rather than for feeding. Observations on the reflex of feigned death in the weevils when disturbed showed that it was most intense at 20–28°C., especially in sunny weather, when the weevils dropped to the ground and feigned death from very slight causes, even the movement of a shadow 2 ft. from them. At temperatures below 15°C. [59°F.] or humidities of over 80 per cent., and in windy weather, the weevils did not react so readily and the periods of torpor were considerably longer. The reflex was also much weaker during the periods of pairing and oviposition than before or at the beginning of sexual maturity.

[SKOBLO (I. S.).] **Скобло (И. С.). Fecundity of the Moths of** *Agrotis segetum* **when fed on Molasses.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 142–144, 1 ref. Leningrad, 1939.

The value of baits of molasses against the adults of *Agrotis segetum*, Schiff. [*cf. R.A.E.*, A **24** 643] has been contested by some Russian workers on the ground that many moths escape from the pans after feeding on the molasses and that the latter tends to increase their fecundity. In laboratory experiments, however, using moths caught on sunflowers, the average periods of survival and numbers of eggs laid were 3·6 days and 194·9 for those given water only, 3·7 days and 209 for those fed on molasses, and 10·8–12·2 days and 662·3–879·2 for those fed on 10, 30 or 50 per cent. solutions of saccharose.

A detrimental effect of molasses on the fertility of the moths was shown more clearly in experiments with females reared in the laboratory from pupae of approximately the same weight. The average periods of survival in days and numbers of eggs per female were 4·9 and 37 for those fed on molasses, 12·2 and 239 for those given water only, 19·2 and 869·4 for those fed on a 10 per cent. solution of saccharose, and 20·9 and 800·7 for those fed on 50 per cent. saccharose. Moreover, dissection of the moths after death showed that in most of those that had fed on molasses the reproductive organs had degenerated.

The author emphasises, however, that further investigations are necessary, since under field conditions the moths might feed on molasses only once or twice and the molasses might be diluted.

[KHARITONOV (Ya.)] **Харитонов (Я.). Results of Black-cyanide Tests as a Means of Controlling Wireworms in Gorkovski Region.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 144–145. Leningrad, 1939.

The experiments described were carried out at the end of August 1936 in the Province of Gor'kiĭ in a field with a clay soil of medium quality and heavily infested with wireworms. Lupin sown there in the spring had been almost completely destroyed by them, and so the field was reploughed and left fallow. The soil was sufficiently moist, and a preparation containing calcium cyanide [*cf. R.A.E.*, A **27** 149] was applied on 29th August at a depth of 8 ins. and rates of 15, 20 or 25 gm. per hole in holes 20 ins. apart in rows that were also 20 ins. apart. To estimate the effectiveness of the fumigation, baits of potato were placed in the soil about a fortnight later at the rate of one to four holes, and examined for wireworms after intervals of 6, 11 and 24 days. Most of those taken were mature larvae of *Corymbites* (*Selatosomus*) *latus*, F., with smaller numbers of larvae of the type of *Agriotes*. The total number of wireworms removed from 10 baits in the treated plots ranged from 1 to 6, as compared with 31–82 in control plots. The differences in the rate of application of the calcium cyanide had no appreciable effect on the numbers taken.

[CHUGUNIN (Ya. V.).] **Чугунин (Я. В.). On Spraying Dates for Controlling** *Carpocapsa pomonella* **L.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 145–148. Leningrad, 1939.

To determine the best dates for spraying apples against *Cydia* (*Carpocapsa*) *pomonella*, L., in the southern Crimea, experiments were carried out in an orchard in the summer of 1931 on trees 25 or 30–35 years old. The spray used contained 1 lb. Paris green and 2 lb. lime in 100 gals. water for the first application and 1¼ and 2½ lb. for all subsequent ones. The rate of application was 2½ gals. per tree, and applications were made on various plots on one or more of the following dates: 25th May, 7th and 18th June, 25th July and 4th August. The first of these sprays was applied just before the closing of the calyx, and the second and fourth 10 days after the mass flights of the adults of the overwintered and first generations. Slight scorching was observed after the first application but not after the others. From the results of examinations of fruits picked from the lower and middle parts of the crowns of the treated trees in late July and late August, it is concluded that a reduction of 60–80 per cent. in the number of infested fruits can be obtained by not less than three applications, and that the calyx spray is the most important for the control of the first generation, while both of the last two cover sprays are necessary against the second.

[SMIRNOVA (O. N.).] **Смирнова (О. Н.). New Methods in the Control of the Vine Burnet Moth.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 149–150. Leningrad, 1939.

In the summer of 1936, experiments were carried out in the Derbent district in Daghestan on the control of the Zygaenid, *Theresimima* (*Theresia*) *ampelophaga*, Bayle, by destroying the males that congregated round small cages containing an unfertilised female placed in the vineyard. The adults, of which the males constituted 41·6 per cent., were on the wing from 1st to 16th July, and rainy weather did not affect the intensity of the flight. A male is able to fertilise 5–6 females, and a female lays about 500 eggs [*cf. R.A.E.*, A **19** 236]. Of males released at distances of 11–22, 33, 66 and 220 yards from a cage containing a female, 100, 50, 10 and 0 per cent. congregated near the cage. It is advisable, therefore, to place the cages about 70 yards apart. Placing the cage on a large sheet of paper coated with banding adhesive proved to be the best means of destroying the males. In this way, the average number of males caught in an hour was 457 as compared with 400 destroyed by hand and 150 trapped by a bait of sweet rye-beer in a plate under the cage. To prevent the laying of fertilised eggs, it would be necessary to trap the males daily during the whole flight period, which averages 20 days.

Another experiment showed that over 96 per cent. of the older larvae could be dislodged by shaking the vines.

[SOKOLOV (A. M.) & BEZRUKOVA (V. F.).] **Соколов (А. М.) и Безрукова (В. Ф.). The Injuriousness of the Flax Flea.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 150–154, 1 graph, 2 refs. Leningrad, 1939.

To determine the extent of the injury caused to flax by flea-beetles in Russia [*cf. R.A.E.*, A **16** 412 ; **25** 575], experiments with potted plants were carried out in 1929, in which from 25 to 100 per cent. of the surface of the cotyledons alone, or also of the leaves as they appeared, was removed, and the height of the damaged plants was measured at harvest time. It was found that those from which 25 or 50 per cent. of the surface of the cotyledons alone had been removed were taller than the control plants, whereas those deprived of 75 per cent. or more of the cotyledons and those from which parts of leaves or entire leaves had also been removed were shorter. The decrease in the height of the plants varied directly with the size of the surface removed and the number of damaged leaves. As the leaves that were partly or completely removed were situated further from the cotyledons, the reduction in height of the injured plants became less. Injury to the leaves alone, or even their complete removal, had less effect on the growth of the plants than injury to the cotyledons. These observations were confirmed in similar experiments in 1934, and observations in that year also showed that the yield of stems and seeds from flax in plots infested to various degrees by flea-beetles was decreased in proportion to the severity of the infestation, and that the weight of lots of 100 seeds and the yield of fibre from the stems was also reduced.

[KALASHNIKOV (K. Ya.).] **Калашников (К. Я.). An Experiment of Preparing in large Quantities Cultures of the Fungus *Metarrhizium anisopliae* Sorok.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 154–158, 1 fig. Leningrad, 1939.

In connection with the control of *Cleonus* (*Bothynoderes*) *punctiventris*, Germ., on beet in the Province of Kiev, a method found satisfactory for the preparation of large quantities of the green muscardine fungus, *Metarrhizium anisopliae* [*cf. R.A.E.*, A **25** 571] is described. The culture medium was potato, small pieces of which, about 1 cc. in size, were first washed three times in cold water to remove the starch from the surface, since if this is not done, the starch turns into paste during the process of sterilisation and renders the potato sticky. Before being transferred to the flasks, the wet pieces were allowed to drain on canvas. The flasks, which were of 250–1,000 cc. capacity, were three-quarters filled with the pieces of potato and then sterilised by steam in an autoclave at a pressure of 1½ atmospheres, the process lasting 40 minutes if the potato was peeled, or 45 minutes if it was not. The initial cultures of the fungus were grown in test tubes from spores on potato slices, and the slices were transferred to the flasks with a long sterilised needle, every precaution being taken to avoid contamination. The flasks were then lightly shaken in order to mix the fungus with the medium. The flasks were kept at 20–25°C. [68–77°F.] and were shaken up every day to prevent the pieces of potato from sticking together. At higher temperatures, mycelium developed and sporulation was hindered. Under favourable conditions, the development of the fungus was completed in 15–20 days. The material was either kept in the flasks, or was dried at 25–30°C. [77–86°F.], either whole or ground. In the latter case, an equal amount of dry sawdust was added to the powder, as this accelerated the process of drying. The drying reduced the weight of the original material by 70–80 per cent.

[Shmal'ko (V. S.).] **Шмалько (В. С.). On the Elaboration of a local Method of eliminating Insects.** [*In Russian.*]—*Plant Prot.* no. 18 pp. 176–181. Leningrad, 1939.

As a result of frequent neglect of rules of pest control, insufficient fumigation, etc., a severe outbreak of granary pests occurred in flour mills in the Russian Union in 1937, and a survey was carried out in July of that year in Moscow and the Province of Voronezh. Of the pests found, the Cucujids, *Laemophloeus testaceus*, F., and *L. ferrugineus*, Steph., and *Tribolium confusum*, Duv., were the most important, and were abundant in all the mills examined. The Cucujids had previously been considered as unimportant and restricted to the south of the Russian Union. In the mills, they occurred in tunnels in crusts of flour that formed on the walls of certain parts of the equipment as a result of the contact of the warm flour with the cold surface of the walls and the condensation of moisture there. *T. confusum* infested thicker crusts than those in which *Laemophloeus* occurred, and was also present in flour dust that accumulated in filter boxes, and on beams, etc. Other pests, in order of abundance, were the mites, *Tyroglyphus farinae*, DeG., and *Lepidoglyphus* (*Glycyphagus*) *destructor*, Schr., *Calandra granaria*, L., *Ephestia kuehniella*, Zell., *Tinea granella*, L., *Tenebrio molitor*, L., *Tenebroides mauritanicus*, L., and *Oryzaephilus* (*Silvanus*) *surinamensis*, L.

Examination of samples of flour, dust, etc., from different parts of the mills showed that the pests usually occurred in the closed inner parts of the equipment. The distribution and abundance there of the most important species are shown in tables. It is suggested, therefore, that control could be obtained by local fumigation of the infested parts of the mills, without previous cleaning. Observations showed that the mechanical removal of the foci of infestation tends to disseminate the pests throughout the building. Such cleaning should therefore be followed by a general fumigation of the whole mill.

[Fishkis (I. S.), Matveev (V. A.) & Morozov (A. A.).] **Фишкис (И. С.), Матвеев (В. А.) и Морозов (А. А.). Naphthalene and its Application in the Control of Granary Mites in Beet-growing Farms.** [*In Russian.*]—44 pp., 12 figs. Voronezh, Izd. VNITO sakh. i spirt. Promuishl., 1936. (Abstr. in *Plant Prot.* no. 18 pp. 187–188. Leningrad, 1939.)

This handbook is intended for the use of growers of sugar-beet in the Russian Union and is based on large-scale experiments carried out in the Province of Voronezh on the control of mites infesting stored beet seed. It contains general information on mites, notes on the importance of the species that infest granaries, their bionomics and the ways in which they spread, and a survey of the infestation by mites of beet seed in beet-growing collective farms in 1935 and of appropriate control measures. Other sections deal with the physical and chemical properties of naphthalene, and its application in general and against pests in large amounts of stored seeds.

From their investigations, the authors conclude that naphthalene is effective against mites in stored beet seed, provided that it is thoroughly mixed with the seed. Covering is not essential, as equally high rates of mortality of mites were obtained in seed that was covered or left unprotected after naphthalene had been mixed with it at the rate of 4–5 parts per 10,000 by weight. Crude naphthalene was cheaper and more effective than the sublimated form, as in seed treated with the latter, 9·5–3·6 per cent. of the mites were still alive after 4 days. Since treating the seed with naphthalene does not free the building from mites, it is important also to devise a method of fumigating the stores with naphthalene.

Heinze (K.). **Zur Biologie und Systematik der virusübertragenden Blattläuse.** [A Contribution to the Biology and Classification of Aphids transmitting Plant Viruses.]—*Mitt. biol. Reichsanst.* pt. 59 pp. 35–48, 11 figs. Berlin, 1939.

In connection with work in Germany on the transmission by insects of virus diseases of potato [*cf. R.A.E.*, A **27** 156, 157, 267], a list is given of the 6 Aphids that develop on potato. They are *Aphis* (*Doralis*) *fabae*, Scop., *A.* (*D.*) *rhamni*, Boy., *A.* (*D.*) *frangulae*, Koch, *Macrosiphum solanifolii*, Ashm., *M.* (*Aulacorthum*) *solani*, Kalt., and *Myzus* (*Myzodes*) *persicae*, Sulz. [*cf.* **27** 634]. Brief notes are given on morphological characters distinguishing the viviparous females; in the author's experiments, the first five transmitted the virus of soy-bean mosaic and that of cucumber mosaic or lupin brown [*cf.* next paper]. Both these viruses are known to be transmitted by *M. persicae.*

A. fabae also transmits virus diseases of beet, bean, pea and clover, but apparently not those of potato. The winter eggs are laid on *Euonymus* and *Viburnum opulus*. *A. rhamni* is the commonest Aphid on potato in Pomerania, but did not transmit any virus of it. Oviposition was observed on *Rhamnus cathartica* [*cf.* **27** 578]. *A. frangulae* oviposits on *R. frangula* and *R. cathartica* and also transmits virus diseases of bean, cabbage, onion and lily. *Macrosiphum solanifolii*, the winter eggs of which are laid on rose, is not apparently of importance in the spread of German potato viruses, but transmits two American ones, and also virus diseases of bean, pea, onion and iris. *M. solani* apparently oviposits on herbaceous plants, including

Digitalis. In experiments, it transmitted leaf-roll of potato, in 5 per cent. of cases, but as it is not common in the field, it is regarded as of very slight importance. It was commoner on beet seedlings in hotbeds, and its feeding sometimes causes serious crinkle and even the death of the seedlings.

Myzus persicae transmits 25 viruses to various economic plants, including potato, and is a serious pest. Measures of control are best directed against the eggs and nymphs on the winter food-plant. Winter sprays should be used against the eggs, which are found on peach, and more rarely on apricot, from the end of October to early March. Before the appearance of winged females, which occurs about 14 days after peach blossoming, migration can be prevented by spraying with nicotine against the nymphs. This nicotine spray does not usually destroy another peach Aphid, *Anuraphis* (*Appelia*) *schwartzi*, Börner, which is unimportant as a virus carrier, but might be mistaken for *M. persicae.* By mid-June, migration to summer food-plants, especially potato and other Solanaceae, was complete. Observations showed considerable difference in the degree of infestation. In June 1937, the number of individuals per potato plant averaged 5,400 near Berlin, but only 25–30 in Pomerania ; a similar difference was also observed in 1938. The development of the infestations and the monthly sums of temperature for May–October in 1936–38 near Berlin are shown in graphs. It is concluded that the high temperature sums in May and early June 1937 resulted in a great increase in the population of *M. persicae,* so that natural enemies were unable to exercise the usual degree of control in the second half of June, although they were normally active. Feeding experiments in Berlin showed that Chrysopid larvae devoured up to 200 Aphids daily, Coccinellid beetles from 60 to 100, Coccinellid larvae up to 50, and Syrphid larvae 20 or more. The abundance of Coccinellids in 1936–37 is shown in a graph.

At the end of September or early in October, winged males and gynoparous females return to peach and apricot, on which the latter produce wingless females that pair with the males and deposit 4–8 winter eggs. The number of return migrants was estimated at 600–1,000 per tree ; the number of eggs per tree was calculated at 15,000-20,000 in Pomerania in 1938.

The winter eggs are very resistant to low temperatures. Experiments to ascertain whether the Aphid is able to survive the winter on the summer food-plants showed that exposure for 24 hours to −13°C. [8·6°F.] was fatal, and that at temperatures of from −8 to −10°C. [17·6 to 14°F.] very few survived after a few days. The recorded winter temperatures for East Prussia, Pomerania, Berlin and the Rhineland are shown in graphs ; they indicate that successful hibernation in the field of the summer form is improbable except in the Rhineland, where the monthly maximum is above 10°C. [50°F.], which permits the Aphid to develop. Viviparae have been observed overwintering in this region on a variety of cabbage resistant to frost.

Heinze (K.). **Uebertragung und Ueberwinterung der Lupinenbraüne-Virus.** [The Transmission and Hibernation of the Virus of Lupin Brown.]—*Mitt. biol. Reichsanst.* pt. 59 pp. 84–86, 1 fig. Berlin, 1939.

The virus of lupin brown (cucumber mosaic 1) was experimentally transmitted on lupins in Germany by *Myzus* (*Myzodes*) *persicae,* Sulz., *Aphis* (*Doralis*) *fabae*, Scop., *A.* (*D.*) *frangulae*, Koch, *A.* (*D.*) *rhamni*, Boy., and *Macrosiphum* (*Aulacorthum*) *solani*, Kalt., and on cucumber by *Myzus ornatus*, Laing, but was not transmitted by various Jassids, Psyllids or weevils that occur on lupins. This virus was not transmitted through the seed, and was conserved during the winter in 17 plants, including cucumber, spinach, tomato, tobacco, various garden plants and several weeds. It is therefore recommended that lupins should not be planted close to gardens, sowings should be made early, and weeds should be eradicated from plantations.

NITSCHE (G.). **Untersuchungen zur Uebertragung des Virus der Rübenblattwanze** *Piesma quadratum* **Fieb.** [Investigations on the Transmission of the Virus of the Beet Leaf Bug, *P. quadratum*.]—*Mitt. biol. Reichsanst.* pt. 59 pp. 87–92, 6 figs. Berlin, 1939.

A brief account is given of the technique adopted in preliminary experiments in Germany on the production of a strain of beet resistant to crinkle, the virus of which is transmitted by the adults of *Piesma quadratum*, Fieb. Nymphs of the Piesmid taken in the field were allowed to moult to the adult stage, and the sexes were then separated. Females transmitted the virus in 25 per cent. more cases than males. The bugs became infective after feeding for only a few minutes on an infected plant and remained so until death.

GÖSSWALD (K.). **Ueber den insektentötenden Pilz** *Beauveria bassiana* **(Bals.) Vuill. Bisher Bekanntes und eigene Versuche.** [On the Entomogenous Fungus, *B. bassiana*. Published Data and original Experiments.]—*Arb. biol. Reichsanst.* **22** pt. 4 pp. 399–452, 1 pl., 15 pp. refs. Berlin, 1939.

In this paper, the author gives a detailed account of laboratory experiments in Germany on the pathogenicity of *Beauveria bassiana* to several species of ants, *Bombyx mori*, L., honey bees, and a number of Rhynchota and Coleoptera from which the fungus has not hitherto been recorded. Under experimental conditions, complete mortality was obtained of all the test insects. He discusses the influence on the development of the fungus of temperature and relative humidity, and describes the technique by which the fungus was cultured. He concludes that existing knowledge does not permit the forecasting of any considerable insect mortality due to the fungus, although it is to be assumed that the latter is favoured by wet and warm weather coinciding with an outbreak of the host.

BÖRNER (C.) & SCHILDER (F. A.). **Die Verbreitung der Reblaus in Deutschland nach dem Stande des Jahres 1938.** [The Distribution of *Phylloxera* in Germany in 1938.]—*Beil. NachrBl. dtsch. PflSch-Dienst* **19** no. 7, 10 pp., 1 map. Berlin, 1939.

Phylloxera was found on vines in over 40 fresh localities in Germany in 1938 [*cf. R.A.E.*, A **26** 601]. Particulars are given of the distribution of the races with the short and long proboscis.

Jancke [O.] & Roesler [R.] **Zur Winterbekämpfung der Traubenwickler mit chemischen Mitteln.** [Regarding Winter Measures with Chemicals against Vine Moths.]—*NachrBl. dtsch. PflSchDienst* **19** no. 7 pp. 58–61, 4 refs. Berlin, 1939. (With a note by F. Stellwaag.)

In view of the favourable results obtained by F. Stellwaag against pupae of the vine moths, *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., with light mineral oils to which contact poisons were added [*R.A.E.*, A **27** 103], laboratory experiments were carried out in the Rhineland in February–April 1939 in which pupae in trap-bands of corrugated cardboard were left in position on small sections of the card and sprayed with various mixtures. It was considered that an insecticide should give at least 95 per cent. mortality to be effective, but this percentage was not given by a 5 per cent. emulsion of tar distillate alone or with 0·2 per cent. nicotine, 1 per cent. of a preparation of pyrethrum or 1 per cent. derris; a proprietary winter oil spray; or nine mineral oils in various combinations with nicotine, pyrethrum or derris. In only one case, in which a light mineral oil with pyrethrum was used on 19th April was 100 per cent. mortality obtained, and this result is considered unreliable.

Field tests with the mixtures were carried out in several localities in the Rhineland, but in no case was satisfactory mortality obtained, as measured by the numbers of adults subsequently caught in trap glasses.

In a supplementary note, Stellwaag suggests that the discrepancy between his results [*loc. cit.*] and those recorded here may be due to insufficient wetting of the pupae by the insecticide. The webs should be so thoroughly sprayed that they remain sodden long enough for the emulsion to break and release the droplets of oil.

Balachowsky (A.). **Sur les dégats et l'extension en France de** *Ceresa bubalus*, **F., membracide américain nuisible aux cultures fruitières.** —*Rev. Path. vég.* **26** no. 1 pp. 39–61, 8 figs., 21 refs. Paris, 1939.

The damage caused to orchard trees in France by *Ceresa bubalus*, L., which was imported from the United States about 20 years ago, has increased within recent years as the distribution of this Membracid has extended. Records of its distribution in Europe [*R.A.E.*, A **27** 474, etc.] are reviewed, and all stages are described; in France it probably occurs in all Departments in the south and south-west [*cf.* **27** 390]. A list is given of other Membracids that occur in France and French North Africa. The bionomics of *C. bubalus* are summarised, partly from the literature. The females deposit groups of 8–15 eggs from late July to mid-October in slits that they cut in the trunk and branches of trees, including pear, plum, cherry, poplar, lime [*Tilia*] and blackthorn [*Prunus spinosa*]. The eggs hatch in the field at the beginning of April, but in the insectary, nymphs have appeared as early as the beginning of March. They feed on the leaves and stems of many low-growing plants, and in June and July 1937 destroyed chrysanthemums and dahlias in a district in the south of France. The severity of the injury due to the oviposition slits, which is permanent and results in loss of vigour and severe stunting in young trees, is related not only to the number of punctures but also to the structure of the food-plant, trees such as pear, in which the cortical layers are thick, being less seriously affected than others such as apple, in which they are thin.

The nymphs can be controlled on cultivated plants by sprays of 24 oz. nicotine sulphate and 1 gal. summer oil emulsion in 100 gals. water, but spraying is impracticable in meadows and fields of clover or on waste land. Oviposition might be prevented by the use of repellents, but their application is complicated by the fact that the fruit is still on the trees during the oviposition period. Recommended measures include clean cultivation, draining damp orchards, and prohibiting the transport of trees bearing eggs.

BRUNETEAU (J.). **La lutte contre le pou de San José** *Comstockiella perniciosa*, **Comst. en Yougoslavie.**—*Rev. Path. vég.* **26** no. 1 pp. 62–65. Paris, 1939.

An account is given of the measures adopted against *Aspidiotus* (*Comstockiella*) *perniciosus*, Comst., in Jugoslavia and Rumania following the discovery of the Coccid five years ago on the common frontier of these countries and Hungary in numbers sufficiently great to indicate that it was widespread throughout all three, together with a brief review of its present position in Jugoslavia and in Austria. The measures adopted in Jugoslavia [*R.A.E.*, A **25** 483], where the position has not improved very much since 1936, include the demarcation of an infested and of a protected zone, the prohibition of the movement of nursery plants and fruit from infested districts to places south of the Drava or Danube, burning infested trees or spraying them in winter with emulsions of tar distillate or mineral oil, and dipping nursery stock in these emulsions or fumigating it with hydrocyanic acid gas. In Rumania, 25 per cent. lime-sulphur (20–25° Bé.) is substituted for oils in the spring, and nicotine sprays are applied on 1st and 15th June, 1st July and 1st–10th September. Enough females to maintain the infestation survive the oil sprays, and fumigation of trees with hydrocyanic acid gas, which would afford complete mortality, is economically impracticable.

Optimum conditions for *A. perniciosus* prevail in Hungary, where there are 3 generations a year. It was apparently introduced into that country before 1914 and into Jugoslavia and Rumania before 1920. It was then spread by the movement of infested nursery stock, but its dispersal with fruit, which was suspected, appears to be almost impossible. In view of the fact that many plants are not quickly killed when attacked by it (apple survives for 10–20 years, whereas pear and peach trees die within two), it is probably distributed throughout temperate Europe, at least on unsupervised or inaccessible trees, where no control measures are adopted. It is suggested that a state of equilibrium will eventually be established, similar to that reached in the case of *Lecanium corni*, Bch., which caused the loss of at least 12,000,000 plum trees in Central Europe up to 1930, but which since then has become of less importance. The increased supervision of orchards and stock imported from countries known or suspected to be infested by *A. perniciosus* and strict control of native Coccids are recommended.

Hudault (E.) & Zelensky (V.). **Contribution à la connaissance de la biologie de la Cecidomyie destructive** (*Mayetiola destructor* **Say) au Maroc.**—*Rev. Path. vég.* **26** no. 1 pp. 93–100, 1 graph, 5 refs. Paris, 1939.

In studies on the bionomics of *Mayetiola destructor*, Say, in Morocco, where it causes serious damage to wheat and barley [*R.A.E.*, A **20** 452 ; **26** 640], mortality was found to be high in the eggs and the first-instar larvae, which died if they were unable to attach themselves under a leaf sheath within five days of hatching ; second-instar larvae, which are the most injurious, were little more than one-third as numerous as the eggs from which they developed. The injuries caused to wheat and barley are described ; on barley, which is the more resistant, infestation is often accompanied by the formation of galls, which may contain several larvae, near the point of attack, but this reaction has not been observed on wheat.

There are usually three generations a year, all of which are active during the growing period of wheat and barley (October–April). Adults from larvae that have diapaused during the summer emerge from October to late February, with a peak in November and the beginning of December [**26** 640], and those of the two succeeding generations from the beginning of January to mid-March and from the end of February to the beginning of April, with peaks in mid-January and mid-March, respectively. The time of emergence of the adults of the aestivating generation is influenced by variations in the rainy season. The larval diapause may be prolonged into the winter, and some larvae of the other generations also diapause, for periods that may exceed a year. The date of adult emergence was not advanced when aestivating larvae were kept throughout the summer in a humid atmosphere and the temperature was temporarily lowered to 3–5°C. [37·4–41°F.].

In the insectary, females oviposited indiscriminately on wheat, barley, oats and rye, but larvae developed only on the first two. Females from larvae from one food-plant oviposited on the other, but the injury caused by the resulting larvae was in all cases that characteristic of the plant. On experimental plots and in the field, damage to wheat and barley in the blade was less severe on strongly growing plants, in which a high percentage of badly damaged stalks was rapidly replaced by several vigorous young shoots. Cultural operations, weather conditions and varietal differences favouring the production of new shoots therefore increase the resistance of the plants to attack, but if this replacement, which is generally better in barley than in wheat, occurs slowly or late, the yield and ripening of the crop is impaired. The importance of attack by later generations on fully grown plants is less if they have withstood infestation in the early stages of growth.

Rungs (C.). **Le cycle évolutif de la cochenille australienne** (*Icerya purchasi* **Mask.) sur le littoral atlantique du Maroc.**—*Rev. Path. vég.* **26** no. 1 pp. 101–105, 5 refs. Paris, 1939.

In studies on the annual cycle of *Icerya purchasi*, Mask., in the open at Rabat during 1938–39, the Coccid passed through four generations, which were present, respectively, in February–June, late June and July, August–October and November–February. The first three generations were on *Acacia* and the last on *Tamarix.*

The conditions of temperature and relative humidity that prevail along the Atlantic coastal belt of Morocco are summarised from the literature, and the influence that these are likely to exercise on the annual cycle of *I. purchasi* in various districts on the coast is briefly discussed.

GARTHWAITE (P. F.). **Entomological Research.**—*Rep. Silv. Ent. Burma 1937–38* pp. 95–104. Rangoon, 1939.

During studies on *Xyleutes ceramicus*, Wlk., infesting teak [*Tectona grandis*] in Burma [*cf. R.A.E.*, A **26** 338], in 1937–38, attempts were made to rear day-old larvae in the insectary. Of 266 larvae, 44 per cent. survived the first month and 31 per cent. the second, and two larvae entered their second year. They were fed during the first month on green shoots of teak and later on billets of wood 2–3 years old. After the second month, these were placed upright with the lower end in a culture solution and the other sealed with wax. Observations on adults showed that females migrated before mating, and that fertilised females placed on teak or other trees all flew away without ovipositing. The females were capable of directional flight at least as strong as that of the males, and therefore of considerable migration. There was no evidence that they oviposit in trees other than the recorded food-plants.

The durations of the egg stage are given for different localities, with the corresponding average maximum temperatures. They ranged from 10 days at 95·7°F. to 20 at 82°. Tests of the viability of eggs at different temperatures and relative humidities showed that at temperatures between 16 and 41°C. [60·8–105·8°F.] hatching was unaffected by either factor. At other temperatures, humidity had a definite effect, but was subsidiary to temperature and to the age of the egg, increase in which reduced resistance to an adverse environment. It is possible that the eggs acquire an induced resistance, since in some experiments the mortality was reduced by intensification of the adverse conditions. Since exposure to ultra-violet and infra-red rays resulted in 25 per cent. mortality after 28 minutes and 100 per cent. mortality after 4 minutes, respectively, it is concluded that the fatal effect of exposure to the direct rays of the sun is due to heat. Relative humidities of 0 and 20 per cent. were more favourable than saturation to eggs exposed to sunlight. The percentages of eggs surviving continuous immersion in water were 100 after 8 hours and 2 after 4 days. None survived longer immersion. The movement of the larvae immediately after hatching was haphazard [*cf.* **26** 339], but after a few minutes, negative heliotropism was shown. Of 100 larvae placed on teak trees, 60 were blown away, swinging out on long strands of silk, and the remainder disappeared into crevices in the bark in an average of 4 minutes and spun protective webs. At favourable temperatures, they were able to live without food for 6 days after hatching, but at temperatures over 40°C. [104°F.] they survived for only 1 day. Except at temperatures below 16°C., humidity was unfavourable to the larvae. Very young larvae are considered to be less resistant to adverse conditions than the eggs. The pupal periods of 12 individuals averaged 95 days for males and 55 for females. One male adult emerged in May from *Gmelina arborea* on which day-old larvae were liberated in 1937 [*cf. loc. cit.*]. *G. arborea* is also attacked by other pests of teak, and should not be associated with teak in regeneration centres.

Hyblaea puera, Cram., was abundant from the end of April to mid-July, and completely defoliated teak in a number of localities. Several species of parasites were obtained from it and some were shipped to Madras. *Hapalia machaeralis*, Wlk., was scarce during the year, and 7 per cent. of the larvae bred from material collected in 13 localities were parasitised, chiefly by *Apanteles machaeralis*, Wlkn. The introduced Braconid, *Cedria paradoxa*, Wlkn. [*cf.* **26** 339] was liberated at 11 points during the year, and was subsequently recovered from 3 of them, having bred under natural conditions. Scolytids of the genus *Xyleborus* were found attacking living teak trees in a plantation in which thinning was overdue. The seed borers, *Eublemma* sp., *Pagyda salvalis*, Wlk., and *Dichocrocis punctiferalis*, Gn., were bred from teak seed collected in September–November in four different localities. From two localities, 70 per cent. of the seeds were affected, chiefly by *D. punctiferalis*.

Small numbers of two-year-old seedlings of *Xylia dolabriformis* were attacked by *Zeuzera coffeae*, Nietn., which killed the leading shoots and sometimes the whole plant. There appeared to be two generations a year, and all stages of the insect were present at the same time. *Achaea janata*, L., was the most important of ten species of Lepidoptera defoliating *X. dolabriformis* ; it also invaded plantations of *Aleurites montana* from the surrounding jungle in the Northern Shan States, but the trees were effectively protected by adhesive bands. Ornamental trees of the genus *Cassia* were infested by *Xyleutes persona*, Le Guillou ; one that was killed by the attack contained 1,500 galleries of the Cossid, all made within three years. Females of *X. persona* were capable of strong directional flight, and one was found by measurement to contain 59,000 eggs. An unmated female laid 10,000 eggs, 14 of which hatched. Practically all the eggs of mated females are viable, and the incubation period is 13–19 days. The larvae fed readily on several species of *Cassia*, but not on teak. Plantations of *Cordia myxa* were seriously defoliated by the Galerucid, *Periclitena vigorsi*, Hope. Pests of stored timber in Rangoon included *Heterobostrychus aequalis*, Waterh., in *Anogeissus acuminata*, and *H. aequalis* and *Lyctus* spp. in *Sarcocephalus cordatus*.

EDWARDS (W. H.). **The Preservation of Wooden Buildings in the Tropics. With special Reference to Conditions existing in Jamaica.**—[5] 32 pp., 11 figs., 11 pls. Kingston, Dep. Sci. Agric. Jamaica, 1939. Price 2*s*. 6*d*.

The introductory chapter of this pamphlet deals with the advantages of using wood as a building material in the tropics and the consequent need of effective measures for protecting it from fungi and termites. The habits of the different kinds of termites in Jamaica are briefly described [*R.A.E.*, A **26** 220]. In the second chapter, methods of preventing the infestation of new buildings are discussed. They include : the eradication of termites from the building site and immediate surroundings by locating and destroying any nests that may be present and burning infested stumps, etc. ; clearing the site of all vegetation and ploughing it, removing the top layer of soil, which is rich in humus, removing all deeply embedded roots and tree stumps and, if there are signs of the presence of termites, injecting carbon bisulphide into the soil or impregnating it with orthodichlorobenzene ; the choice of properly seasoned timber and the application of preservatives to susceptible wood ; building foundations in such a way that the wooden parts of the structure are inaccessible from the ground, and using termite shields [**17** 730] ; screening ventilators and taking other precautions to prevent infestation by dry-wood termites, and making judicious use of wood preservatives. Methods of repairing buildings that are already infested are dealt with in the third chapter. Means are described of detecting infestation and determining its causes. The measures advocated include the application of insecticides in powdered, liquid or gaseous form, the correction of structural defects when this is possible and alternative palliative measures when it is not, and the replacing of timber infested by dry-wood termites. Common structural defects are described and illustrated. The measures described in these two chapters are summarised in the two that follow.

Papers noticed by Title only.

VAPPULA (N. A.). **Finnish Entomological Literature published in 1938 including** [91 titles on] **Economic Entomology and Control of Insect Pests.**—*Ann. ent. fenn.* **5** appx. 22 pp. Helsingfors, 1939. [*Cf. R.A.E.*, A **26** 695.]

SUBKLEW (W.). **Zur Morphologie der Larve von** *Melolontha hippocastani* **Fabr.** [The Morphology of the Larva of *M. hippocastani*.]—*Arch. Naturgesch.* (N. F.) **7** no. 2 pp. 270–304, 24 figs., 39 refs. Leipzig, 1938.

[BEREZHKOV (R. P.).] **Бережков (Р. П.). Key to the Acridids of Western Siberia.** [*In Russian.*]—92 pp., 59 figs. Novosibirsk, Izd. Zap. sib. kraev. Izd., 1937. Price 2 *rub.* (Abstr. in *Plant Prot.* no. 18 p. 187. Leningrad, 1939.)

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